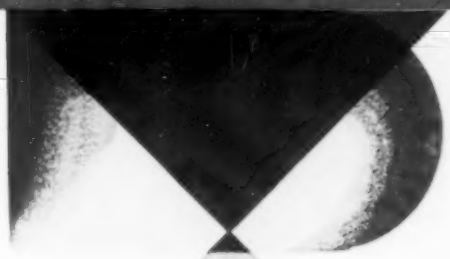
Petroleum Processing

INCLUDING PETROCHEMICAL SECTION SEPTEMBER, 1955



Petrochemicals

1955 REPORT

- Where we are, and Where we're going p. 1387
- Equipment for the processing plants p. 1393
- 4th annual directory p. 1413

ALSO IN THIS ISSUE

WHEN TO USE ALLOY STEELS — And how to pick the right one . . . p. 1364

TANKS CORRODING? — Cathodic protection may be your answer . . p. 1372

IT'S HURRICANE TIME — And here's a plan for coping with it . . . p. 1378

A McGRAW-HILL PUBLICATION

The **FOX Gas Processing Plant** was designed and constructed by Hudson in collaboration with Signal Oil and Gas Company. The plant design includes features reflecting a combination of the long experience of Signal in the operation of similar plants with the experience of Hudson in designing, constructing and initially operating more than 100 major projects for the oil and gas industry.

When additions now in progress are completed by Hudson, approximately 60 million cubic feet per day of casinghead gas from the Fox and nearby fields of Carter County, Oklahoma, will be processed, and about 3,000 barrels per day of finished products will be recovered from the gas.

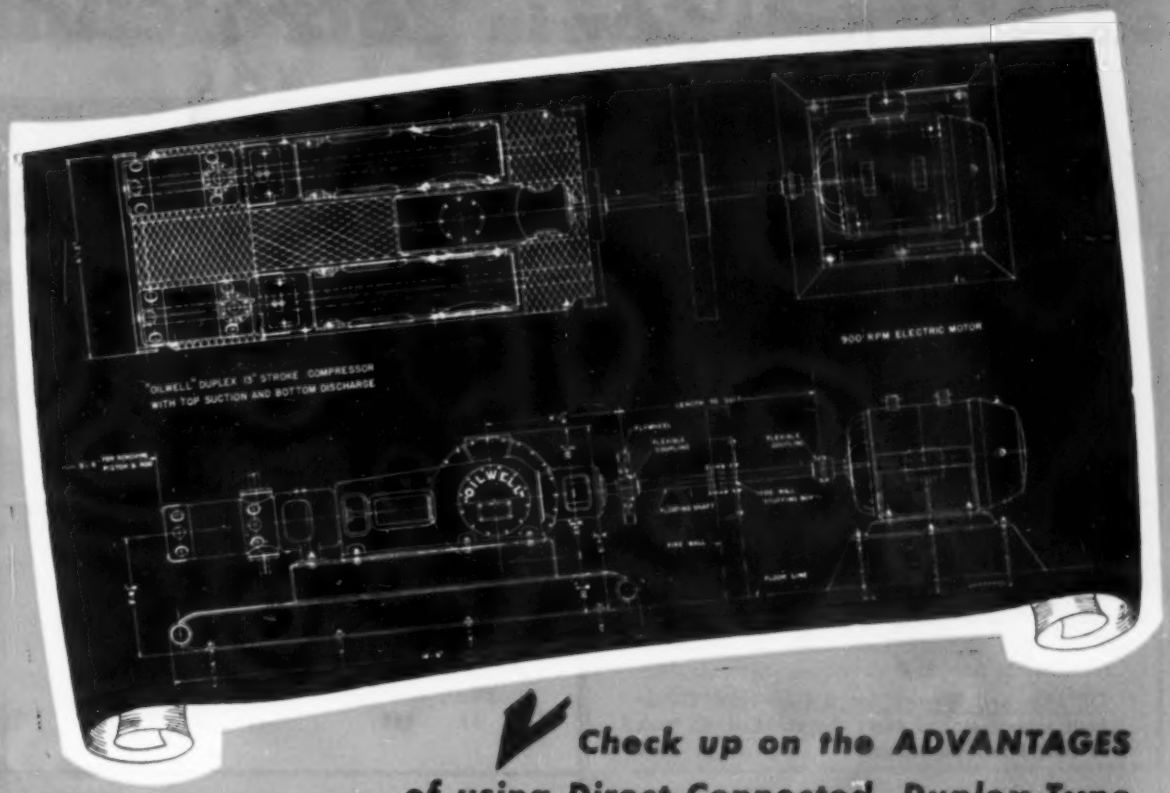
Hudson is happy to add Signal Oil and Gas Company to its long list of clients, and particularly proud that through the coordinated efforts of Signal and Hudson this major project was completed in 7 months — from first discussion to smoothly operating plant.

DESIGNERS AND CONSTRUCTORS OF
OIL AND GAS PROCESSING PLANTS

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

SINGLE or MULTIPLE Units!



Check up on the ADVANTAGES of using Direct-Connected, Duplex-Type

"Oilwell" Compressor Units

. . . for Gas Compression in Refineries

"OILWELL" UNITS of this type are slow speed; designed with direct drive through right-angle gears to two parallel compressors so as to utilize 300 hp. input from a single prime mover with maximum efficiency.

For applications in the larger-volume-low-pressure range, single-stage compressors can be furnished. Where higher pressures are required, multi-stage compressors can be furnished to develop discharge pressures to 3,000 p.s.i.

Installations in hazardous areas can be made with maximum safety, by incorporating a fire wall between unit and driver as indicated in the sketch.

Where gas concentrating operations exceed the capacity of a single compressor unit, multi-unit installations are highly practical because they permit the routine servicing of individual compressors when necessary without shutting down the entire operation.

Let your "Oilwell" Representative . . . quote on "Oilwell" Compressor Units to meet the gas-concentrating requirements of your refinery.

OIL WELL SUPPLY
DIVISION
UNITED STATES STEEL CORPORATION

Executive Office—DALLAS, TEXAS
Export Office—
30 ROCKEFELLER PLAZA
NEW YORK 20, N. Y.

Area Offices — CALGARY, CANADA
CASPER, WYOMING . . . COLUMBUS, O.
DALLAS, TEXAS . . . HOUSTON, TEXAS
TULSA, OKLA. . . . LOS ANGELES, CALIF.

Branches Serving All Oil Fields

USS

"OILWELL"

TRADE MARK

UNITED STATES STEEL

Reader's Guide

What's New in Petroleum

Does Your Community Know You?

The "Toledo Story." How four refineries in that city have worked together since 1951 promoting the oil industry in the entire Lucas County area. A story in five parts, by Edward P. King, beginning on p. 1359

How It All Started—The thinking that went into the development of this program. **p. 1359**

Operation Cooperation—What the Toledo refiners are succeeding in accomplishing. **p. 1360**

Oil Men and Women for a Day—How Toledo high school seniors carry the story of oil back to their fellow classmates. **p. 1360**

How Teachers Learn from Refiners—The separate program for opening refinery doors to educators. **p. 1362**

And Refiners Go Back to School—Plant personnel revisit the classroom. **p. 1363**

I 3 5

When to Use the Alloy Steels

For pressure vessel designers, eight helpful charts giving the proper shell wall thickness, weight per square foot, and cost factors for 10 commonly used steels, in four important temperature ranges, up to 950°F. By William H. Funk. **p. 1364**

I II III 2 4

How Are the Germans Doing?

West Germany's refining industry has made a 600% increase in capacity. Estimate for 1955 is pegged at 244,000 b/d. A staff report by the Editors, with tables of data, and a map. **p. 1368**

I 3 5

"Juice" Is Cheaper than Downtime

Cathodic protection, long used for preventing pipe line corrosion, may be the answer to your plant corrosion trouble. How it works and what it will do for tank bottoms and other underground structures. By Wayne A. Johnson. **p. 1372**

I II III 2 3 4

Aviation Lube Oil Tests a Problem?

Here's a bench-scale method aimed at predicting lube performance under actual conditions. It simulates flight operation and is recommended for screening the additive type oils. By F. G. Hess, F. E. Landis, and A. R. Rescorla. **p. 1374**

I 1 3

It's Hurricane Time Again

Even if your plant is not in the usual storm area, it will pay you to study this successful disaster plan for rapid plant shutdown and personnel evacuation, developed by Dow Chemical Co. By D. P. Thornton, Jr. **p. 1378**

I II III 3 4 5

A McGRAW-HILL PUBLICATION

ABP ABC

Member of Associated Business Publications and Audit Bureau of Circulations

Petroleum Processing is published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948) founder.

Publication Office: 330 West 42nd St., New York 36, N. Y.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Circulation Director.

Subscriptions: Address correspondence to Petroleum Processing, Subscription Service, 330 West 42nd St., New York 36, N. Y. Subscription rates: domestic single copies, 35c. U. S. and possessions, Canada, and all other countries, $2 per year. $3 for two years, $4 for three years. Orders must indicate company and position.

Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology. Entered as second class matter March 12, 1954, at the Post Office in New York, New York, under the act of March 3, 1879. Printed in U.S.A.

Copyright 1955 by McGraw-Hill Publishing Co., Inc. All rights reserved.

Processing for September, 1955

PETROLEUM REFINING I | PETROCHEMICAL MANUFACTURING II | GAS LIQUIDS RECOVERY III | RESEARCH & DEVELOPMENT 1 | DESIGN & ENGINEERING 2 | PLANT OPERATION 3 | MAINTENANCE & CONSTRUCTION 4 | MANAGEMENT & PERSONNEL 5

Petrochemicals–1955 Report

A special 42-page section in 3 parts

1—ECONOMICS—The State of the Industry
2—EQUIPMENT for the Processing Plant
3—The PLANTS—and What They Make

ECONOMICS

Things Are Looking Up

Output of petrochemicals this year will be up an estimated 13%. Gas may lose out to oil as favored raw material. More mergers and tie-ins of petroleum and chemical companies are seen. By V. B. Guthrie. **p. 1387**

I II III 1 3 5

ECONOMICS

These Are the Ones to Watch

Here are the petrochemicals that will lead the expansion parade–that will have outputs of half a billion pounds or more annually–that will push total petrochemical output to 30-35% of all chemicals by 1960. **p. 1390**

I II III 1 3 5

EQUIPMENT

What Can Alloys Do for You?

Here's how they are being applied to specific petrochemical plant problems–to prevent product contamination, provide physical strength, and assure both corrosion and erosion resistance. By Robert L. Davidson. **p. 1393**

I II III 2 3 4

EQUIPMENT

For Gas Purification Units

What sort of operating problems do you encounter and what sort of special equipment designs have been worked out to overcome them? Here are the answers, based on 25 years of experience with the process. By Norman C. Updegraff. **p. 1396**

I II III 2 3 4

EQUIPMENT

For Sulfur Recovery Units

How to select the equipment which will recover waste heat, avoid metal sulfiding, insure plant flexibility–and solve other operating problems in both these and similar type processing units. By Dellason Bress. **p. 1400**

I II III 2 3 4

EQUIPMENT

What's New for the Plant

More than 50 reviews of new and recent equipment and materials developments–selected by the editors of PETROLEUM PROCESSING because of their particular interest to engineers designing, building and operating the plants. **p. 1404**

I II III 2 3 4

PLANTS

Who Makes What Petrochemicals

Our 4th Annual Petrochemical Directory, a complete listing of the 327 plants in the U.S. and Canada–raw materials, products, capacities, key personnel. **PLUS**–an index to each of them by the products they make. **p. 1413**

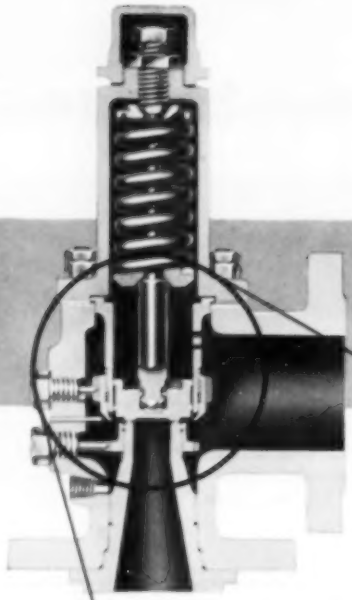
I II III 2 3 4 5

DEPARTMENTS

Publishers Page	1291	Personals	1441
What's Happening	1293	Patents	1445
Tomorrow	1297	Suppliers	1453
Letters	1299	Meetings	1461
Operating Trends	1301	Books	1465
Plant Practices	1429	Information Offered	1470
Lab Practices	1435	Advertisers' Index	1472
New Words	1439	What's New	1473
News in Views	1439	Editorials	1504

HOW TO USE IT:

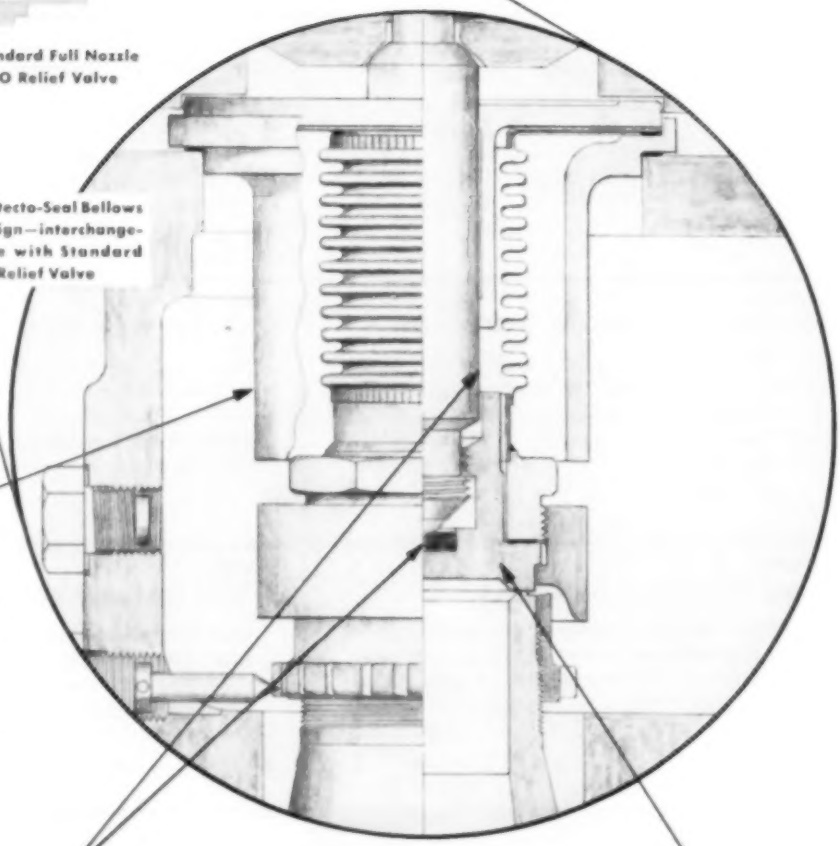
Your new "Reader's Guide to What's New in PETROLEUM PROCESSING" will do two things for you. First, the key numbers with each article will tell you at a glance if it is within your scope of interest; Roman Numerals indicate industries; Arabic Numerals, fields of activity. Second, the longer descriptions will tell you what each article is about, and why it can be of help and interest to you. –THE EDITORS



CROSBY Protecto

Standard Full Nozzle JO Relief Valve

Protecto-Seal Bellows Design—interchangeable with Standard JO Relief Valve



EXCLUSIVE

BELLOWS PROTECTOR
(Pat. Applied for)

1. *Isolates and protects Bellows from turbulence caused by flowing media—reducing tendency of Bellows to fatigue.*
2. *Acts as positive lift-stop thereby preventing over compression of the Bellows.*

EXCLUSIVE

1. All moving parts are guided and held in perfect alignment from a single member.
2. The floating disc is loaded at the lowest point possible in the disc to provide the best in alignment stability and seat tightness.

FLOATING DISC

1. Simplifies maintenance.
2. Ease of dis-assembly.
3. Permits remachining.
4. Anti-fouling.

Seal Bellows Relief Valve

The addition of the Crosby Protecto-Seal Relief Valve to the well known line of Crosby JO Relief Valves marks a forward step in the design and construction of valves primarily for use on services where protection against corrosion, fouling of working parts, and low back pressure surges is required. The design represents the results of field tests conducted under the severest operating conditions.

The design of the valve is featured by the EXCLUSIVE Bellows Protector which shields the Bellows from adverse turbulent effects from the flowing media, preventing premature failure of the Bellows due to fatigue. The two ply bellows is so designed that the effective area of the valve seating surface is essentially balanced to nullify the effect of variable and constant back pressure on the performance of the valve. Now, with the Protecto-Seal Valve and the Balanced Area Piston Type Valve, Crosby offers relief valves for the widest range of back pressure conditions.

The Protecto-Seal construction is available in eleven orifice sizes and is interchangeable with the present line of Full Nozzle JO Relief Valves. Pressure-temperature scopes and dimensions remain the same as listed in the present 300 Catalogue. Valves available with internal heating coils and flushing nozzles on request.

Send operating data to Wrentham for recommendations.

Proven Performance

Designed, tested, and proved in our own steam and water test laboratories over a wide range of pressures. Performance checked on:

GAS—A.S.M.E. Test Facility
VAPORS—Wide range of temperature and Pressure
LIQUIDS and FLASHING FLUIDS—Private Laboratories and Power Plants of a leading Public Utility

This Valve has been tested for performance and flow at pressures from 25 p.s.i. to 2500 p.s.i.

CROSBY STEAM GAGE & VALVE COMPANY

FACTORY: WRENTHAM, MASSACHUSETTS

BOSTON • NEW YORK • CHICAGO • DALLAS • LOS ANGELES • LONDON • PARIS

 (To obtain more data on advertised products see page 1472)

General American

offers you the best in

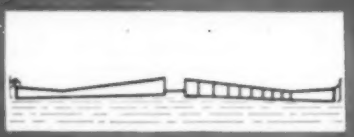
All types of Floating Roofs

WIGGINS HIDEK*

This is the natural design for storage of volatile products. A variable volume of vapor trapped beneath the steeply-pitched, quick-draining deck adds to its efficiency.

WIGGINS LODEK*

Designed so that the underside is in complete contact with the liquid surface. No vapor space can exist beneath the floating roof. Especially recommended where corrosive products are stored.



WIGGINS DOUBLEDEK*

If you prefer a double-deck roof choose the best—the new Wiggins Doubledek. Complete drainage design and between-deck accessibility add up to unmatched efficiency and safety.

WIGGINS FLOATING ROOFS PAY FOR THEMSELVES

Whatever your Floating Roof requirements get General American's UNBIASED analysis. Unbiased because General American makes ALL types of Floating Roofs!

Wiggins Floating Roofs, Dry Seal Gasholders, Lifter Roofs, Cone Roofs

*patented

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street • Chicago 90, Illinois

Petroleum Processing

A McGRAW-HILL PUBLICATION

Editorial & Business Offices
330 West 42nd St., New York 36, N.Y.

Harry L. Waddell, Publisher

Editorial Staff

William F. Bland, Editor
William C. Uhl, Managing Editor
Virgil B. Guthrie, Associate Editor
Robert L. Davidson, Assistant Editor
Willis A. Bussard, Assistant Editor
Alan Corneretto, Assistant Editor
William A. Caperell, Jr., Art Director
Stuart D. Boynton, Editorial Assistant
Grace McKay, Editorial Assistant
D. P. Thornton, Jr., Southwestern Editor
W724 Prudential Bldg., Houston 25
Richard R. Elwell, West Coast Editor
1111 Wilshire Blvd., Los Angeles 17
Andrew R. Patla, Washington Editor
1188 Nat'l. Press Bldg., Washington 4
Peter J. Gaylor, Patent Reviewer

Business Staff

K. W. McKinley, Advertising Sales Mgr.
R. H. Loyer, Business Mgr.
John E. Thompson, Production Mgr.
George Reid (Houston)
Assistant to the Publisher

Regional Sales Representatives

NEW YORK 36, N. Y.
Fred R. Emerson, 330 West 42nd St.
Walter W. Patton, 330 West 42nd St.
PHILADELPHIA 3, PA.
Fred R. Emerson, 17th and Sansom Sts.
ATLANTA 3, GA.
S. T. Henry, 801 Rhodes-Haverty Bldg.
CLEVELAND 15, OHIO
William R. Freeman, 1510 Hanna Bldg.
CHICAGO 11, ILL.
Robert W. Bruley, 520 N. Michigan Ave.
HOUSTON 25, TEXAS
J. H. Cash, W724 Prudential Bldg.
DALLAS 1, TEXAS
J. H. Cash, First Nat'l Bank Building
SAN FRANCISCO 4, CALIF.
T. Evans Wyckoff, 68 Post St.
LOS ANGELES 17, CALIF.
William C. Woolston, 1111 Wilshire Blvd.

Publisher's Page

Why We're in Petrochemicals

READERS ask us now and then why we devote as much attention as we do to Petrochemicals—how we justify a petroleum magazine covering chemical activities. Since this issue contains our annual Petrochemical Section (42 pages, with a complete contents listing on p. 1385) let's explore the subject.

We first began publishing more than an occasional story on chemicals from petroleum back in 1942, when we ran the 7-article series "ABC of Chemical Derivatives from Petroleum" by Wakeman and Weil.

It wasn't until 10 years later, however, that we thought chemicals from petroleum—which in the meantime had been dignified with the name "petrochemicals"—had reached the status of requiring more formalized attention. And in April 1952 we launched our "Petrochemical Section."

Our thinking then was—and still is—that there is a tremendous amount of similarity between a refinery and a petrochemical plant. They employ the same types of raw materials—hydrocarbons. They use the same kinds of processing techniques and tools—cracking, absorption, heat transfer, fractionation, and the like. They operate on the same basic pattern—continuous fluid flow, 24 hours a day, 7 days a week. And because of these similarities they encounter the same operating and maintenance problems.

One of the first things we had to do when we embarked on our petrochemical coverage was to arrive at an acceptable definition of the word. We did—after corresponding with nearly a hundred individuals and talking personally with several dozen more. Here it is, unchanged since we evolved it: "Petrochemical—a chemical compound or element recovered from petroleum or natural gas or derived in whole or part from petroleum or natural gas hydrocarbons and intended for chemical markets." We don't claim that there is yet unanimity as to what a petrochemical is—but our definition appears to be the most commonly accepted one.

Another thing we had to do was conduct a census of the industry—which has been continued on an annual basis. Our first census—in 1952—showed just over 70 companies operating some 130 petrochemical plants. Our 4th census (pp. 1413-1428 in this issue) lists 187 companies and 327 plants. We think that's a pretty hefty growth picture.

All of which leads us to make this prediction: We have every intention of keeping both ourselves and you up-to-date on petrochemicals, which we belive are a basic part of petroleum processing.

William F. Bland

Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The monthly magazine of oil marketing—news, prices, transportation, storage merchandising

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago, Houston

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago, Houston

Petroleum Week
The industry-wide magazine—covering production, processing, transportation, marketing

... as corrosive as hydrochloric acid

... as critical as caustic soda

... as volatile as chloroform

as viscous as molasses

problem liquids are stored safely in General American tank storage terminals

Easy-to-handle liquids and problem liquids alike . . . they're all in a day's work for the men at General American terminals. Storage capacity of over half-a-billion gallons is available for any liquid that can flow through a pipeline.

Facilities are also available for blending to your specification . . . for drumming, barreling and canning to meet your needs. You get the privacy, service, safety and flexibility of your own terminals without capital investment.

By maintaining liquid inventories at General American terminals, you can fill rush orders for your customers or meet your own needs quickly, efficiently and economically.

It Pays To Plan With General American

Terminals located at:

Port of New York (Carteret, N. J.)
Port of New Orleans (Good Hope, La.)
Chicago, Illinois (Bedford Park)
Port of Houston (Galena Park and Pasadena, Texas)
Corpus Christi, Texas

GENERAL AMERICAN TANK STORAGE TERMINALS

a division of **GENERAL AMERICAN TRANSPORTATION CORPORATION**

135 South La Salle Street • Chicago 90, Illinois

What's Happening

in Refining

. . . **Esso Standard Oil Co.** has taken options on about 1,800 acres near Penns Grove, N. J. Penns Grove is on the Delaware River, directly across from Wilmington and about 30 miles southeast of Philadelphia. Although Esso emphasizes that it will not consider plans for development of the site until exhaustive tests have been completed, size and location seem to indicate that it may be used for a new refinery. Also, Esso states that any use will be based on "the value of the site for future expansion possibilities and not upon the withdrawal or reduction of any existing facility."

. . . **American Gilsonite Corp.** has selected a site near Fruita, in the vicinity of Grand Junction, Colo., for its new $10-million Gilsonite refinery (see What's Happening, Aug. '55, p. 1097). Output of plant, which will process 600 to 700 tons of Gilsonite per day, hasn't been announced, but observers estimate it at between 5,000 and 7,500 b/d of petroleum products. Bids on the project will be opened Sept. 23, and completion is now expected in early '57.

. . . **Southwestern Oil & Refining Co.** has started construction of a 9,000 b/d Platformer at its Corpus Christi, Texas, refinery, with operation scheduled for early next year. Company recently received a certificate of necessity for such a unit, with an estimated investment of $2,145,000. Included in the Platformer installation will be a rerun column designed to produce selective fractions of reformate with controlled boiling ranges.

. . . **Aurora Gasoline Co.** is converting its 7,000 b/d UOP Platformer to a 5,500 b/d Rexformer, with the revamped unit expected to be operating by Jan. 1, 1956.

. . . **Cosden Petroleum Corp.** is installing a 3,900 b/d Rexformer at its Big Spring, Texas, refinery, to be designed by UOP, built by Procon. Also under construction, with refinery personnel, is a 1,600 b/d Unifiner, which will desulfurize portion of feed stock for both new Rexformer and an existing Platformer. Rexformer completion is set for late next spring; Unifiner is due to go on stream shortly.

. . . **Aviation Fuels Co.,** a new firm, has received certificate of necessity for a $24,800,000 refinery at Beaumont. Although proposed plant would have crude charging capacity of only 8,000 b/d, it would include 2,600 b/d isomerization unit, 4,500 b/d dehydrogenation unit, and 5,200 b/d alkylation unit—apparently depending on outside sources to supply some feed stocks. Aviation Fuels Co. is a reorganized version of Avtane Refining Co. (see What's Happening, Aug. '54, p. 1143, and Sept. '54, p. 1299), whose plans for a 10,000 b/d refinery at Freeport, Texas, reportedly fell through. Principles of firm haven't been identified, except that A. Leon Ro-Sene is listed as vice-president, and address is given as c/o Tears Engineers, Dallas, Texas.

. . . **Cities Service Oil Co.** plans to spend up to $5-million next year expanding its Ponca City, Okla., refinery. In addition to 6,000 b/d Rexformer (see What's Happening, Aug. '55, p. 1097), company plans to up crude charging capacity from present 25,000 b/d to 35,000 b/d. Procon will build the UOP-designed Reformer, other contracts have not yet been announced. Construction is due to start by first of '56.

. . . **Tide Water Associated Oil Co.'s** expansion program at Avon, Calif., (see March 1955, p. 303) seems to be shaping up this way: A 42,000 b/d fluid coker, being built by Bechtel Corp. and set for May '56 completion; 24,000 b/d hydrodesulfurization unit; new gas plant, and expansion of existing Fluid catalytic cracking unit. New facilities will increase refinery's gasoline output by about 30%.

. . . **Continental Oil Co.** plans to add 1,500 b/d catalytic reformer (unidentified) to its Artesia, N. Mex., refinery, at an estimated cost of $500,000. Completion is scheduled for about Jan. 1, 1956.

. . . **Magnolia Petroleum Co.** will add a 28,000 b/d Thermofor Catalytic Cracker and 20,000 b/d Sovaformer to its Beaumont, Texas, refinery—part of a $25-million expansion project there.

. . . **El Dorado Refining Co.** will serve as its own contractor for construction of its new 2,500 b/d Platformer, at its El Dorado, Kans. refinery, to be built at an estimated cost of $750,000. Construction was scheduled to start Sept. 1, with completion due by February '56.

. . . **Canadian Gulf Oil Co.** has let contract to Mannix Gill Ltd. of Calgary, Alberta, for a $2-million natural gasoline plant in the Settler Gas Conservation area, Alberta.

in Petrochemicals

. . . **There are now 187 companies in petrochemicals** in the U. S. and Canada, according to the 4th Annual Petrochemical Survey just completed by PETROLEUM PROCESSING—and reported in this issue, pp. 1413-1428. These companies have 289 plants now in operation, with 38 totally new plants under construction or planned, and 58 expansion projects in the works. Investment-wise, existing facilities represent over $3-billion. New plants and expansion projects will add close to another $1-billion. For more details on petrochemicals, see the special section beginning on pg. 1385 in this issue.

. . . **Brin Chemical Corp.** will operate newly-constructed $100,000 plant in Tulsa to recover phenols, xylenols and cresylic acids. Raw material will be treating wastes from refinery cracking units in the area. Plant was scheduled to be in operation by Sept. 1. Officers of new firm are Harold Bottomley, president; B. T. Brown, vice-president and general manager; D. N. Irwin, vice-president and chief engineer; and C. E. Wilson, secretary-treasurer.

. . . **Imperial Oil Ltd.** has set up a new Chemical Products Department to handle the manufacture and sale of petrochemicals, with offices at 434 University Ave., Toronto. Department will consist of a technical division (to select and plan manufacturing processes), and a sales division (to market products, offer technical assistance to customers, and develop new uses for petrochemicals in Canada).

. . . **Cosden Petroleum Corp.** will convert existing 4,000 b/d Platformer at its Big Spring, Texas, refinery to 100% aromatics operation. Company is now installing a new Rexformer, which will provide gasoline blending stocks now coming from Platformer.

. . . **Continental Carbon Co.'s** carbon black plant at Eunice, New Mexico, will be expanded with the addition of new facilities to produce 25-million lbs. of SRF (semi-reinforcing, furnace) black annually. Raw material will be natural gas. New plant is expected to be on stream in the first quarter of '56. Continental's Sunray, Texas, plant has already been expanded by 6-million lbs. of FEF (fast extrusion, furnace) black annually. Sale of all Continental black production is handled by Witco Chemical Co. (Note: Capacity figures given above received too late for inclusion in 1955 petrochemical directory.)

. . . **Pitt-Consol Chemical Co.** will operate the cresylic acid refinery at Newark, N. J., formerly owned by Reilly Tar & Chemical Corp., producing cresols, cresylic acids, phenol, resins and molding powders. The plant has just been purchased by Pittsburgh Consolidated Coal Co., parent of Pitt-Consol Chemical. The new owner has begun construction of additional facilities and renovation of some existing ones; total investment after modernization will be $3- to 3.5-million. Feed stocks initially will come from petroleum refinery waste streams, but Pitt-Consol anticipates that it will also be able to use liquid fractions from the coal company's low temperature coal carbonization process. The latter, it says, "is now ready for commercial use."

. . . **Goodyear Tire & Rubber Co.** plans to expand by 50% capacity of the synthetic rubber plant at Houston it recently bought from U. S. government. Plant at present has a capacity of 137,500 long tons/yr. When first phase of expansion is completed, set for early '57, capacity will be 170,000 tons. At the same time, preliminary work will be done for a second capacity boost—to 200,000 tons.

. . . **Last remaining synthetic rubber plant,** at Institutes, W. Va., is again up for sale. The GR-S government-built unit, with a capacity of 122,000 long tons/yr., received no bids during earlier sale when 25 other plants were disposed of to private industry. Prospective purchasers have until Oct. 7 to submit bids.

in Markets and Prices

. . . **August was an "up period"** for petroleum products in principal primary supply markets. Prices for most oils pointed higher, with substantial gains chalked up for gasoline in the Mid-Continent, heating oil at the Gulf, and both residual and distillate fuels along the Atlantic Coast.

Mounting inventories to the contrary, refiner-buyers were active in the Gulf cargo market for heating oil. It took sales of only three cargoes to push the price of No. 2 fuel up 0.25¢/gal.

In the Midwest, the call for motor fuel appeared to be insatiable; many a refiner has been on the buying side of the market this summer. And that's not hard to understand: Output in District 2 thus far this year is up only 2% while demand has jumped nearly 8% as compared with last year.

. . . **There's no doubt about it.** Refiners are enjoying a much better summer market this year than last. To wit, these higher prices reached recently (with year-ago prices in parentheses):

Group 3 regular-grade gasoline, 11¢/gal. (10.5¢); Gulf Coast No. 2 fuel, 8.5¢/gal. (8¢); New York harbor No. 6 fuel, $2.68/bbl. ($2.15); Pennsylvania bright stock, 17.5¢/gal. (14.5¢).

. . . **There were persistent soft spots,** however, Mid-Continent distillate fuel inventories were top-heavy to the point where some refiners were faced with shutting down for lack of storage space. Group 3 No. 2 fuel price was down 0.125¢ to 8.125¢.

in Transition

. . . **Reilly Tar & Chemical Corp.** (no. 245 in the Petrochemical Directory in this issue) has sold its cresylic acid refinery at Newark, N. J. to Pitt-Consol Chemical Co. See item under "Petrochemicals" for more details.

. . . **Lion Oil Co.** will become a division of Monsanto Chemical Co. if stockholders approve of the merger agreement made in mid-July by directors of both firms. Stockholders meet Sept. 23. Lion has a refinery in El Dorado, Ark., and petrochemical plants in both El Dorado and Lulling, La. If merger goes thru, Lion would continue to operate under its own name.

"Completed by more than 7,000 Indian workers in the record time of eighteen months, despite two of the worst monsoons in Bombay's history, India's first major multiproduct refinery has imparted added firmness to the total economic picture of the country."
Bombay's Two Worst Monsoons

YET LUMMUS FINISHED 6 MONTHS AHEAD OF SCHEDULE

The first large, modern refinery in all India — with a crude capacity of 25,000 B/D — was completed by Lummus in July 1954 for Standard-Vacuum Oil Company.

Located on Bombay harbor, the new refinery was completed in 18 months — *six months ahead of schedule* — despite extraordinary difficulties.

One hundred sixty inches of rain fell in the area during the 1953 monsoon, and 180 inches in 1954, creating special drainage and grading problems and seriously interfering with work schedules. Insufficient roads made necessary the moving of heavy vessels by barge. Hundreds of the 7,000 Indian workmen employed on the job had to be trained in skills and construction techniques new to that country.

This is just one more example of how Lummus meets the challenge of difficult conditions. Our staff and facilities can complement *yours* on your next project.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y. *Engineering & Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Fabricated Piping Plant:* East Chicago, Indiana.

LUMMUS

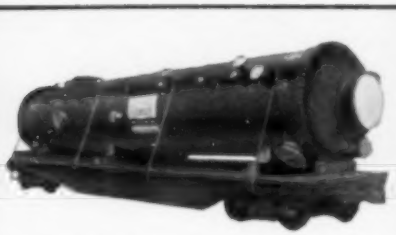
DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

Enroute

GRAVER

PRECISION FABRICATIONS

meeting Industry's most exacting standards



STAINLESS CLAD TOWER

CARBON STEEL TOWER

SOLID STAINLESS TOWER

ALUMINUM TOWER

Where precision craftsmanship is required in tough-to-handle metals, you may rely on Graver. Nearly a century of experience in building tanks, combined with resourceful creative engineering, helps to explain the continuous flow of Graver vessels to the process and petroleum industries.

This is especially true in the fabrication of towers and vessels of alloys and aluminum. Here Graver's rigid quality control, sound welding research, and ability to work to close tolerances result in highest quality products. For *really difficult jobs,* look to Graver!

GRAVER

PROCESS VESSELS

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL. • CATASAUQUA, PA. • PITTSBURGH • CLEVELAND • DETROIT • TULSA • SAND SPRINGS, OKLA. • HOUSTON • ODESSA, TEXAS • CASPER, WYO. • LOS ANGELES • FONTANA, CAL. • SAN FRANCISCO

Research Widens on Use of Atomic Energy as an Aid for Processors

WITH three petroleum companies now working or soon to be working on research programs aimed at using atomic energy as a processing tool, the possibilities for this potentially important new field are gaining momentum rapidly. Using a variety of approaches, the companies include:

Atlantic Refining Co., with its "electronic gun," (resonance transformer), which was announced in August, and which has been in experimental use for about four months.

Socony Mobil Oil Co., which also announced in August that it was launching a two-pronged attack: (1) participation with seven other companies (non petroleum) in construction of the first nuclear reactor to be owned and operated by private industry; and (2) establishment of a nuclear research center wholly owned and operated by Socony Mobil Research Laboratories.

Esso Research and Engineering Co., whose project with radioactive cobalt as a radiation source was announced last December[1] and got under way at Linden, N. J., about two months ago.[2]

Other petroleum companies are understood to be carrying on research in this direction but have not yet made public their activities.

Up to now, heat, along with pressure and catalysis, has been the essential tool of the petroleum processor. Researchers are now seeking to use radioactive energy as a means of speeding up reactions or possibly even find new reactions.

What kind of reactions? The possibilities seem to be many. Atlantic reported it has made hydrazine —a rocket fuel—by bombarding ammonia with atomic radiation. They emphasize, however, that at this point the yield of hydrazine is too low to be profitable. But the fact it can be done clears a mighty big hurdle.

Several other possibilities have been cited by Socony Mobil Oil Co. Cracking may be carried out using the heat from a nuclear reactor together with its radiation in a more efficient manner than is presently possible by conventional thermal and catalytic methods.

Hydrocarbon molecules can be cross-linked by nuclear radiation. Cross-linking of paraffin wax, for instance, will change its properties drastically. Its molecular weight and melting point are increased. With sufficient radiation, the wax will be converted into a high molecular weight, insoluble, grease-like substance.

Further details on the newly announced methods of studying atomic energy will be described in a longer feature article in PETROLEUM PROCESSING in the very near future.

Judging by the amount of effort, money, and research going into these several programs by at least three oil companies so far, it would be a safe bet that radioactivity will soon take its place among the many process tools used by the oil industry.

—W.C.U.

(1) "Atomic Energy a Process Tool?" PETROLEUM PROCESSING, Jan., 1955, pp. 43-46.
(2) "The Study of Radiation as a Process Tool," ibid., Aug., 1955, pp. 1152-53.

Those 1956 Automobiles and What They Will Want in Fuels

WHAT do processors face in terms of fuels requirements for the new 1956 model cars soon to be on the roads?

Two out of every five of the 1956 models will need premium gasoline. By the end of this year the national average octane rating of that gallon of premium fuel may nudge the 97 mark. These predictions are based on advance technical data on the new models obtained directly from the car manufacturers.

Here's how the model changes and trends will affect petroleum.

Viewed conservatively, about 4% of the total 1956 automobile production will be with engines requiring premium grade gasoline. One V-8 this year seems to fit into the premium grade class on the basis of increased compression ratio. However, the manufacturer insists he will recommend regular grade fuel. Our own estimate is based on the premise that 50% of the new cars will need premium. There are some industry estimates that *all* of these engines will require high octane gasoline. If this is true, then better than 45% of all cars made during the next 12 months will feature high compression engines designed to operate on premium gasolines.

If we add about 2,750,000 premium fuel cars to those already on the road, the percentage of premium to regular grade gasoline sales will rise to 34.7% from last year's 32.8%.

The story of this increased premium fuel demand is to be found in the rapid rise in compression ratios in 1956 model cars.

Out of 57 new models, 47 will be upping their compression ratios over last year—some going up as much as 1.2 numbers. This means about 96% of the cars produced next year will have higher compression ratios than in 1955.

One out of every five new cars will have compression ratios of 9:1 or higher, with 9.75:1 the peak at this writing. There is some speculation that one or more of the 9.71:1 models might at the last minute go up to 10:1.

It is also possible that this rapid upsurge in compression ratios may prove the incentive for a rather general increase in octane for all premium fuels by mid- or late-fall. At least one oil industry man has told us the big boost in compression ratios may prompt some marketers to break out with 100 octane gasoline.

The picture differs somewhat for regular grade gasolines. Although regular grade octane ratings hit a national average of 88.5 in July, premium fuel had

hit 95.8, according to Ethyl Corp.'s July octane survey. And the rise for regular has not been as fast as for premium. To handle engines with compression ratios of 8.25:1 to 8.5:1, regular fuel would have to hit the 90 level.

This points to an increasingly greater share of sales for premium gasolines. Refiners as well as marketers will be watching the octane demand data carefully for the next 12 months. —H.R.

Newer Processes for Polyethylene Keep Overall Future Bright

THE outlook for polyethylene plastic may be only temporarily embarrassed by surpluses as additional capacity starts coming in to swell the 250,000,000 lb/yr at the beginning of 1955 to 400,000,000 by the end of this year, and to over 500,000,000 in 1956. Those who believed earlier that the new low pressure polymerization processes might make obsolete the present high pressure capacity—due to the more rigid characteristics of the former product—are wrong.[1, 2]

Manufacturers state that the new forms of this important plastic will not displace the older forms but, instead, will open new markets.

Furthermore, current production of the more rigid low pressure polymer will cost about 10¢/lb more than the older material, the cost of which already is trending downward and shows no inclination yet either to flatten out or to reverse itself.

On the other hand, some users of the present, less rigid material, will welcome a more rigid variety, even at higher prices. And some think it may displace some rubber and styrene. Research is continuing to find different varieties of the polymer and develop new uses.

New opportunities in food packaging are seen for this plastic film, in wrapping fresh farm produce not now packaged—consequently spoiling rapidly. Contractors already have started using it to some extent to keep work dry in bad weather or even to "wrap the building in it." Toys are being relied upon to soak up a considerable quantity of the more rigid materials.

One of the big markets now is in plastic pipe. This has by no means reached its maximum. Some of the more rigid varieties may find especial usefulness, too, if their application is not limited by loss of strength on heating to moderate temperatures.

If research eventually produces a polyethylene which can withstand temperatures of several hundred degrees, regardless of strength, it will be a boon to handlers of corrosive materials. This can mean more applications in chemical plants because of the material's chemical inertness, and its resistance to thermal and mechanical shock, or where vibration is a problem. Containers could be lined with heat stable polyethylene, as is now done with rubber and glass.

For the oil industry, all this means still more demand for either ethylene or the hydrocarbons from which it is made. Some plants also may find it desirable to put up ethylene producing units of their own. It seems doubtful that natural gasoline plants will find it desirable to produce ethylene. However, continued expansion in ethylene chemistry may help find a home for their products. —D.P.T.

(1) "Polyethylene"—CEP Trends, *Chemical Engrg. Progress*, June 1955, p. 31.

(2) "Plastics for Chemical Engineering Construction—Polyethylene", by F. J. Bockhoff, and R. F. Roth, Ibid., p. 251-56.

Paint Manufacture Seen as One New Outlet for Polybutadiene

A PHILLIPS Petroleum Co. research man has discovered how to make a liquid polymer from butadiene with a number of intriguing end uses.* It can be used in surface coating formulations, as a liquid impregnant for glass cloth to make laminates, and as an effective softener for natural and synthetic rubbers. It is definitely not the same thing as the rubber paints which have been on the consumer and industrial markets for several years.

An immediately indicated usage is in enamels for food cans. The polybutadiene is free from odor and taste, and is highly resistant to corrosion. If the polymer is heated in the absence of air to 500° F., a highly cross-linked, transparent resin of exceptional temperature stability is formed. A high gloss protective coating with a strong hard finish can be produced by mixing the polymer with a common metallic drier and a mineral solvent. Two coats on wood will withstand hammer blows without excessive cracking or turning white.

This might well turn into another important use for butadiene, beside its now well-known incorporation into synthetic rubber, nylon, and other materials.

Glass laminates, such as the corrugated and flat sheet products now being extensively used in architectural work, could be one major outlet. And the enamelling of food containers is no small market if polybutadiene takes a chunk of it. The polymer might also prove to be an excellent alternative for varnish, both in the home and for exterior finishes.

Phillips' process for making the polybutadiene involves reaction in a solvent at elevated temperatures in the presence of sodium catalysts, more catalyst being required than in the production of the more well-known rubber materials.

The polymer is highly unsaturated, has a molecular weight of 1300, a viscosity of 2500 centipoises at 100° F., and a specific gravity of 0.91. It contains only about 80% of the theoretical double bonds and demonstrates the presence of cycloolefinic rings in the ultra-violet spectrometer.

One further potentiality for the polymer is this: Maleic anhydride will react with it to form a highly cross-linked polymer which shows possibilities as an ion-exchange resin insoluble in water, caustic, and organic solvents. —D.P.T.

* "Liquid Polybutadiene," *Chem. & Engrg. News*, July 4, 1955, p. 2851.

Letters

Development by Selas

To THE EDITOR: We are greatly disturbed to note a serious error made in the article entitled "Try the Gradiation Heater for Economic Ethylene Production," which appeared in your August issue [p. 1211].

The article states that "A development of joint research by Phillips Petroleum Co. and Selas Corp. of America, the furnace has been trade named the Selas Gradiation Heater."

This statement is completely incorrect. The Selas Gradiation Heater is an exclusive Selas development and is fully covered by Selas patents.

It is difficult to comprehend how such an error could have been made, inasmuch as the original manuscript carried no such mention or implication. Reference was made, in the manuscript, to the cooperative tests conducted by Selas and Phillips in evaluating equipment performance, and it is likely that this misconception was introduced in the editing.

We regret that an otherwise excellent presentation was marred by such an unfortunate error.

ERNEST S. KOPECKI
Manager
Public Relations and Promotion
Selas Corp. of America
Philadelphia, Penna.

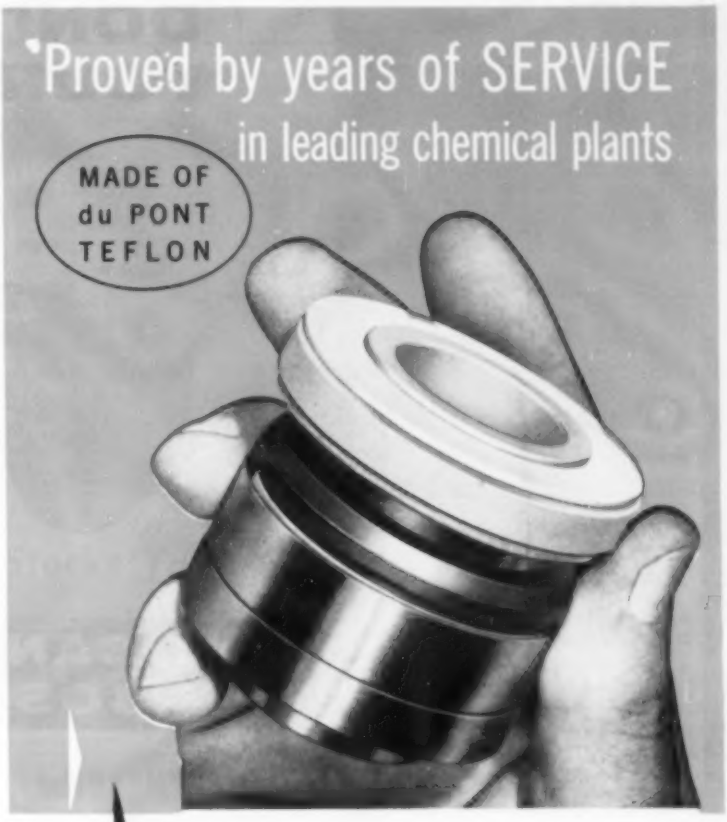
• PETROLEUM PROCESSING's *editors likewise regret and apologize for the error introduced by over-zealous editing. The misconception as to whose development the heater is apparently resulted from the fact that a large portion of the full-scale test work reported in this article has been carried out as a joint program by Selas and Phillips. An earlier article describing the heater* (PETROLEUM PROCESSING, *June, 1951, pp. 616-617*) *had come from a technical paper by Phillips Petroleum Co. engineers.*

Do It Yourself

To THE EDITOR: I was interested in the story "Can You Save Design Hours with Photo Blueprints?" [March, p. 348]. Will you please furnish the address of Parco Co., Inc., and also of Industrial Models, Inc.

F. M. LEVERETT
Chief Power Engineer
The Texas Co.
Port Arthur, Texas

• *Parco is at 82 Beaver St., New York 5, N. Y.; Industrial Models at 2311 Sconset Rd., Wilmington 3, Del.*



CHEMISEAL SHAFT SEALS

Customers report unsurpassed performance and much longer life under a wide variety of chemical service conditions, with Chemiseal Mechanical Seals.

A superior material—duPont TEFLON, and a one-piece balanced bellows design are responsible.

Chemiseals rotate with shaft. Only bearing surface is between precision ground stationary and rotating faces—the latter being an integral part of the TEFLON bellows unit.

Advantages include: Applicable to all chemical requirements, including clear, abrasive and tarry materials. Seal drop-tight and stay tight. Low friction load on shaft. No scoring of shafts—shafts already scored can be satisfactorily sealed. Pressures at the seal to 100 psi at 75° C or 75 psi at 100° C. Standard sizes ⅛" to 2½". Other sizes on special order. Over-all length 2½".

Write for Bulletin No. MS-954.

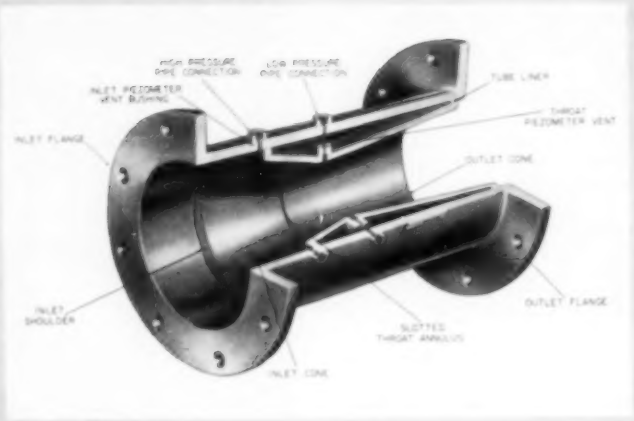
UNITED STATES GASKET CO., Camden 1, N. J.

UGS

FABRICATORS OF FLUOROCARBONS AND OTHER PLASTICS

Representatives in principal cities throughout the world

DON'T LOSE YOUR HEAD!



IT CAN PROVE COSTLY!!!

THE PROBLEM

Head loss can prove expensive. The natural gas industry finds this increasingly true as the booming market for this commodity makes the industry more "efficiency conscious". Modern conservation practices have become a must . . . and a definite trend toward replacing the conventional orifice plate with the Dall Flow Tube has started.

THE SOLUTION

The Dall Flow Tube operates with the lowest head loss obtainable with any known velocity-increasing differential producer. This flow measuring device is unsurpassed for differential pressure recovery . . . with consequent savings in pumping and transmission costs. These advantages apply over a full range of throat-to-line-diameter ratios. Besides providing a maximum in power savings, additional savings can be realized at initial installations. A single Dall Flow Tube can replace several parallel large orifice runs requiring longer approach sections of straight pipe.

Additional Features

★ *The discharge coefficient of the DFT is stable and constant over a wide flow range (for flows above a Reynolds number of 300,000). Complete range data are available on request.*

★ *"Enduring accuracy" is achieved since Dall Flow Tubes are self-scouring and of such rugged, durable construction that all critical dimensions and surfaces remain unchanged even after years of service. The size and weight of these units provide ease of installation.*

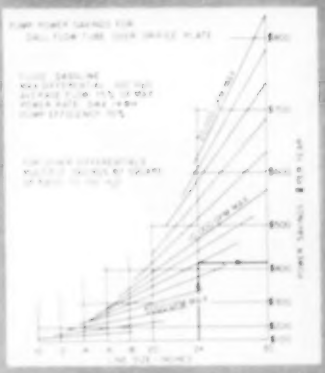
"THE BEST COSTS LESS"

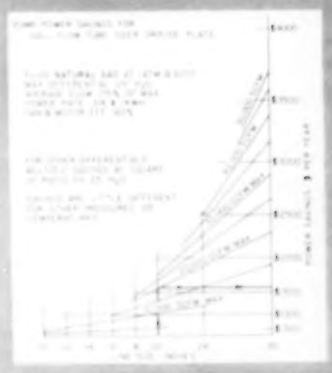
TECHNICAL DATA

PUMP POWER SAVINGS

Annual savings to users of Dall Flow Tubes may be approximated by referring to the charts below. Each is entered at the bottom at the appropriate line size and traced vertically to the intersection with the sloping flow line corresponding to the maximum capacity of the meter installation. The annual pumping power savings read along the vertical scale (right-hand side) opposite this intersection.

Although gasoline and natural gas are used in the examples, the order of yearly savings for other fluids is generally the same. Gases under other line conditions do not yield cost values markedly different from those shown.





Fabricated Dall Flow Tubes, which combine the advantages of the DFT profile and insert or flange mounting, are also available. The structure is a strong weldment of rolled plates and bar. All surfaces which are critical to the accurate prediction of flow characteristics are precisely machined to the Dall formula. This model offers design flexibility, low initial cost, and a wide choice of materials to suit application.

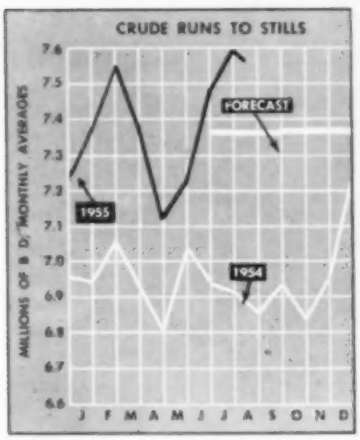
For complete details, write today for Bulletin 115-L1. Also ask for information on secondary instruments. Builders-Providence, Incorporated, 447 Harris Avenue, Providence 1, Rhode Island.

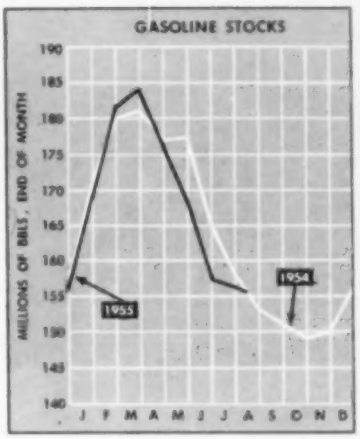
BUILDERS-PROVIDENCE

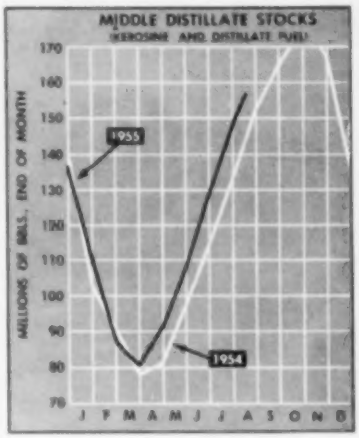
DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.

BIF METERS FEEDERS CONTROLS







1955 figures to Aug. 19

Interior Distillate Stocks Topheavy

Outlook: U. S. Distillate stocks Sept. 30 will be nearer 140,000,000 bbls. than the 130,000,000 bbls. required to balance supply and demand needs.

POSSIBILITY of refiners overstocking on distillate fuel oil was only a cloud on the horizon a few weeks ago. Currently a storm threatens in some areas.

For the U. S. these inventories Aug. 12, were 122,214,000 bbls., over 14,000,000 bbls. higher than at the same time in 1954. They represent approximately 64 days' supply at the rate of demand forecast for the last quarter of 1955. Inventories Aug. 13, 1954, 107,753,000 bbls., were 59 days' supply actual rate of demand of 1,827,000 b/d for the last three mo.

Total distillate inventories today would be even higher except for the fact that the East Coast district refiners' operations have not been stepped up this year to the same degree as in other districts, due mainly to the closing down in February of the Tide Water 87,000-bbl. plant at Bayonne. These refiners actually built up their distillate stocks 86% from April 1 to Aug. 12. Had they built them up by 124%, as did the interior refining districts, East Coast stocks Aug. 12 would have been around 8,000,000 bbl. more than they are.

For the Ind.-Ill.-Ky. district, distillate inventories Aug. 12 were 24,876,000 bbls., 160% higher than on April 1. They compare with 22,512,000 bbls. in storage Aug. 13, 1954. Aug. 12 inventories represent 76 days' supply at the rate of actual demand in this district for the last quarter of 1954, 328,000 b/d.

Gasoline demand continues to be higher than anticipated. However, the higher rate of refinery operations enables the demand to be met without heavy withdrawals from refiners' storage. Gasoline stocks East of California Aug. 12 were 135,334,000 bbls.; Aug. 13, 1954, they were 137,470,000 bbls.

East Coast gasoline inventories Aug. 12, 34,403,000 bbls., were about 1,000,000 bbls. less than Aug. 13, 1954. Gulf Coast stocks were 3,600,000 bbls. larger. Those in the Ind.-Ill.-Ky. district were 2,800,000 bbls. smaller. In the Okla.-Kans.-Mo. district they were more in line with a year ago.

AUGUST KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Aug. 1955*	July 1955	Aug. 1954
CRUDE OIL			
U. S. Production	6.661	6.623	6.168
Imports	.737	.788	.664
U. S. Stocks	262,469	268,638	281,043
Runs to Stills	7.561	7.599	6.862
GASOLINE			
Refinery Output	3.779	3.732	3.391
Refinery Demand	3.952	3.948	3.649
Primary Stocks	155.563	156.854	153.168
MIDDLE DISTILLATES			
Refinery Output	1.893	1.876	1.755
Refinery Demand	1.402	1.250	1.173
Primary Stocks	158.410	149.084	152.528
RESIDUALS			
Refinery Output	1.100	1.114	1.069
Imports	.295	.256	.249
Total Supply	1.395	1.370	1.318
Refinery Demand	1.345	1.354	1.272
Primary Stocks	46.349	45.405	56.332

*Through Aug. 19.

PRODUCT AND CRUDE PRICES

Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Aug. 1955*	July 1955	Aug. 1954
Gasoline	11.49	11.38	11.36
Distillate Fuel Oil	8.91	8.88	8.71
Kerosine	10.40	10.45	10.23
Residuals	4.73	4.59	3.83
Above 4 Products	9.02	8.92	8.64
Lube Oils	17.42	16.86	16.30
Crude	2.82	2.82	2.81

REFINERY YIELDS

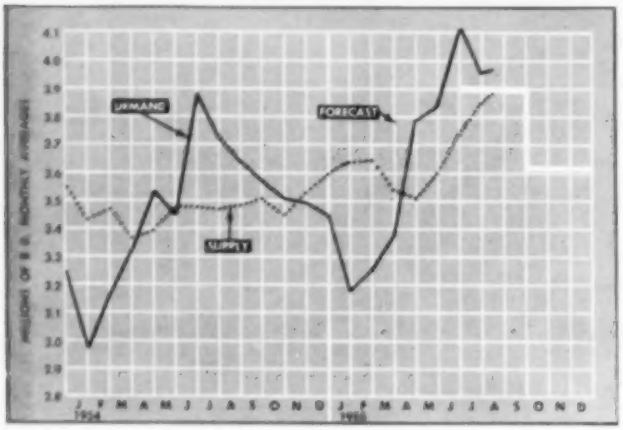
% on Crude Runs to Stills

	Aug. 1955*	July 1955	Aug. 1954
Gasoline	45.8	44.9	43.8
Kerosine	4.0	3.8	4.3
Distillate	21.0	20.9	20.8
Residuals	14.6	14.7	15.3

*Through Aug. 19.

SOURCE OF DATA (except prices): June, July and Aug., API weekly reports; earlier months, Bureau of Mines

Gasoline Output Pushed to Record High

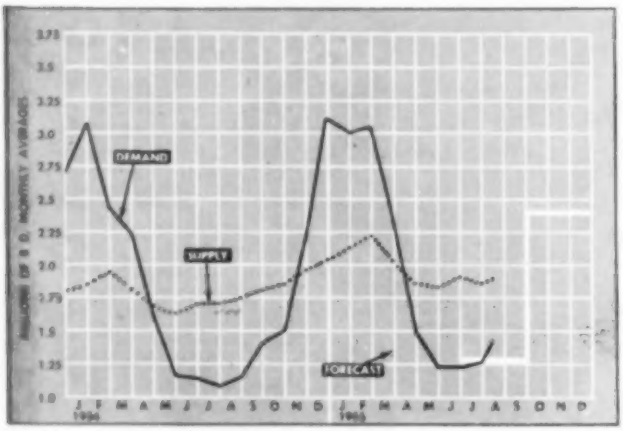


1955 figures to Aug. 19

MOTOR FUELS

	From Crude	From Nat. Gas.	Total
SUPPLY (Millions of b/d)			
July '55	3.413	.424	3.837
July '54	3.068	.412	3.480
Change	+.345	+.012	+.357
% Change	+11.2	+2.9	+10.3
DEMAND (including Exports) (Millions of b/d)			
July '55			3.948
July '54			3.723
Change			+.225
% Change			+6.0
TOTAL SUPPLY (Millions of bbls.)			
7 Mos. '55	684.862	89.001	773.863
7 Mos. '54	643.794	86.967	730.761
Change	+41.068	+2.034	+43.102
% Change	+6.4	+2.3	+5.9
TOTAL DEMAND (including Exports) (Millions of bbls.)			
7 Mos. '55			774.653
7 Mos. '54			730.897
Change			+43.756
% Change			+6.0

Price Advances Sharpen Distillate Demand

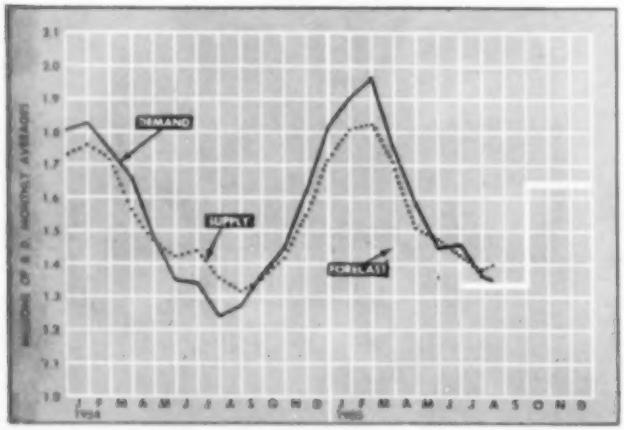


1955 figures to Aug. 19

MIDDLE DISTILLATES

	Kerosine	Dist. Fuel Oil	Total
PRODUCTION (Millions of b/d)			
July '55	.286	1.590	1.876
July '54	.295	1.416	1.711
Change	−.009	+.174	+.165
% Change	−3.1	+12.3	+9.7
DEMAND (including Exports) (Millions of b/d)			
July '55	.210	1.040	1.250
July '54	.174	.932	1.106
Change	+.036	+.108	+.144
% Change	+20.7	+11.6	+13.0
TOTAL PRODUCTION (Millions of bbls.)			
7 Mos. '55	70.004	350.045	420.049
7 Mos. '54	71.919	303.541	375.460
Change	−1.915	+46.504	+44.589
% Change	−2.7	+15.3	+11.9
TOTAL DEMAND (including Exports) (Millions of bbls.)			
7 Mos. '55	65.154	342.185	407.339
7 Mos. '54	68.650	317.048	385.698
Change	−3.496	+25.137	+21.641
% Change	−5.1	+7.9	+5.6

Steady Good Demand for Residuals



1955 figures to Aug. 19

RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
July '55	1.114	.256	1.370
July '54	1.089	.270	1.359
Change	+.025	−.014	+.011
% Change	+2.3	−5.2	+0.8
DEMAND (including Exports) (Millions of b/d)			
July '55			1.354
July '54			1.243
Change			+.111
% Change			+8.9
TOTAL SUPPLY (Millions of bbls.)			
7 Mos. '55	245.640	89.710	335.350
7 Mos. '54	247.611	77.160	324.771
Change	−1.971	+12.550	+10.579
% Change	−0.8	+16.3	+3.3
TOTAL DEMAND (including Exports) (Millions of bbls.)			
7 Mos. '55			343.409
7 Mos. '54			323.160
Change			+20.249
% Change			+6.3

SOURCE OF DATA: June, July and Aug., API weekly reports; earlier months, Bureau of Mines

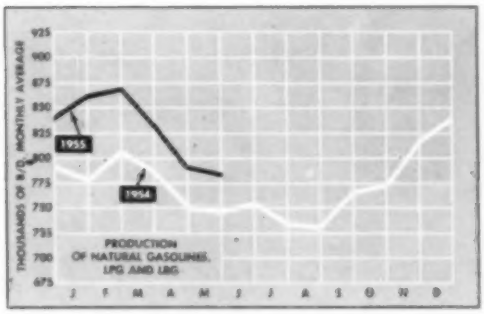
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

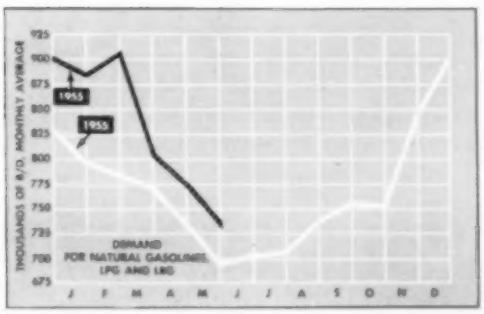
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Aug. 12 1955	Aug. 13 1954	Change	% Change	GASOLINE STOCKS (Millions of bbls. on date shown) Aug. 12 1955	Aug. 13 1954	Change	% Change	RESIDUAL STOCKS (Millions of bbls. on date shown) Aug. 12 1955	Aug. 13 1954	Change	% Change
East Coast	1.044	1.027	+ .017	+ 1.7	34.403	35.423	— 1.020	— 2.9	11.365	11.606	— .241	— 2.1
Gulf Coast	2.592	2.142	+ .450	+21.0	30.420	26.805	+ 3.615	+13.5	7.829	7.258	+ .571	+ 7.9
Total Coastal	3.636	3.169	+ .467	+14.7	64.823	62.228	+ 2.595	+ 4.2	19.194	18.864	+ .330	+ 1.8
Appalachian	.192	.188	+ .004	+ 2.1	6.345	6.627	— .282	— 4.3	.829	.822	+ .007	+ 0.9
Ind.-Ill.-Ky.	1.394	1.301	+ .093	+ 7.1	33.022	35.868	— 2.846	— 7.9	5.250	4.854	+ .396	+ 8.2
Okla.-Kans.-Mo.	.676	.587	+ .089	+15.2	15.194	15.872	— .678	— 4.3	1.118	1.204	— .086	— 7.1
Other Inland	.637	.576	+ .061	+10.6	15.950	16.875	— .925	— 5.5	2.262	2.268	— .006	—
Total Inland	2.899	2.652	+ .247	+ 9.3	70.511	75.242	— 4.731	— 6.3	9.459	9.148	+ .311	+ 3.4
Total East of Calif.	6.535	5.821	+ .714	+12.3	135.334	137.470	— 2.136	— 1.6	28.653	28.012	+ .641	+ 2.3
California	1.112	.914	+ .198	+21.7	19.649	18.858	+ .791	+ 4.2	17.052	27.661	—10.609	—38.4
Total U. S.	7.647	6.735	+ .912	+13.5	154.983	156.328	— 1.345	— 0.9	45.705	55.673	— 9.968	—17.9

District	DISTILLATE FUEL OIL STOCKS (Millions of bbls. on date shown) Aug. 12 1955	Aug. 13 1954	Change	% Change	KEROSINE STOCKS (Millions of bbls. on date shown) Aug. 12 1955	Aug. 13 1954	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbls. on date shown) Aug. 12 1955	Aug. 13 1954	Change	% Change
East Coast	41.823	35.761	+ 6.062	+16.9	12.746	13.134	— .388	— 2.9	54.569	48.895	+ 5.674	+11.6
Gulf Coast	19.145	16.840	+ 2.305	+13.7	6.021	6.364	— .343	— 5.4	25.166	23.204	+ 1.962	+ 8.5
Total Coastal	60.968	52.601	+ 8.367	+15.9	18.767	19.498	— .731	— 3.7	79.735	72.099	+ 7.636	+10.6
Appalachian	3.744	2.474	+ 1.270	+51.3	1.151	1.033	+ .118	+11.4	4.895	3.507	+ 1.388	+39.6
Ind.-Ill.-Ky.	24.876	22.512	+ 2.364	+10.5	8.649	8.434	+ .215	+ 2.5	33.525	30.946	+ 2.579	+ 8.3
Okla.-Kans.-Mo.	13.547	11.960	+ 1.587	+13.3	2.180	1.895	+ .285	+15.0	15.727	13.855	+ 1.872	+13.5
Other Inland	7.163	5.547	+ 1.616	+29.1	1.729	1.849	— .120	— 6.5	8.892	7.396	+ 1.496	+20.2
Total Inland	49.330	42.493	+ 6.837	+16.1	13.709	13.211	+ .498	+ 3.8	63.039	55.704	+ 7.335	+13.2
Total East of Calif.	110.298	95.094	+15.204	+16.0	32.476	32.709	— .233	— 0.7	142.774	127.803	+14.971	+11.7
California	11.916	12.659	— .743	— 6.2	.335	.396	— .061	—15.4	12.251	13.055	— .804	— 6.2
Total U. S.	122.214	107.753	+14.461	+13.4	32.811	33.105	— .294	— 0.9	155.025	140.858	+14.167	+10.1

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS
Bureau of Mines Data

CURRENT PRODUCTION (1000 b/d monthly average)	May 1955	Apr. 1955	May 1954
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	317	333	304
Natural Gasoline and Isopentane	280	272	268
Condensate	15	17	28
Finished Gasoline, Naphtha and Other	59	63	57
Total Natural Gasoline and Cycling Plant Production	671	685	657
Liquefied Refinery Gases	111	108	90
Total Marketable Gas Liquids	782	793	747
Lease Condensate	111	112	101
Total Natural Gas Liquids	893	905	848

CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	371	417	345
Natural Gasoline, Isopentane and Other	366	358	350
Total Marketable Gas Liquids	737	775	695

CUMULATIVE PRODUCTION (1000 bbls.)	May 1955	May 1954
LPG and LRG	70,885	64,457
Natural Gasoline, Isopentane and Other	53,860	52,332
Total Marketable Gas Liquids	124,745	116,789

CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	70,008	61,474
Natural Gasoline, Isopentane and Other	53,726	52,594
Total Marketable Gas Liquids	123,734	114,068

STOCKS (1000 bbls., end of month)	May 1955	Apr. 1955	May 1954
LPG and LRG	8,634	6,859	7,460
Natural Gasoline, Isopentane and Other	4,792	5,176	4,626
Total Stocks	13,426	12,035	12,086

PROCESS UNITS

A DESIGN AND CONSTRUCTION SERVICE

BY

mBc

ENGINEERS

SOME 1954–1955 PROJECTS

- Aromatics and Paraxylene
- Catalytic Polymerization
- Higher Alcohols
- Naphthalene
- Gasolene Treating
- Lube Oil Additives
- Spirituous Liquors

Variety ... A TEST OF VERSATILITY

Versatility ... A MEASURE OF EXPERIENCE

Engineering

Design and Construction of Process Plants

•

Design and Construction of Process Units

•

Process Evaluations

•

Economic Studies

We offer the services of a full staff of plant and unit design engineers to whom the two descriptive words: *versatile* and *experienced* apply. And what is equally important, these process engineers are complemented by engineers specializing in power, air conditioning, structures, hydraulics, instrumentation and other major phases of engineering. Skilled field construction crews and supervising operating engineers complete the picture of a project turned over to the customer — not just ready to go but in full operation.

BADGER MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE 41, MASS. • 60 EAST 42nd STREET, NEW YORK 17, N.Y.

PETROLEUM CHEMICALS DIVISION
NEWS

September ★ One of a Series of Interest to the Petroleum Industry ★ 1955

Fast-rolling "MAGIC BARREL" now smaller, lighter

As a public relations tool for individual refiners and the petroleum industry, the "Magic Barrel" shows steadily increasing value.

In the first quarter of 1955, more than twice as many "Magic Barrel" presentations were made as were made in the same period of 1954. In March alone, an audience of 66,789 witnessed the presentation.

Now to make it more convenient for speakers who make the presentation, a smaller, lighter barrel is available.

The number of shelves has been cut from 16 to 9. This has been done without sacrificing any props or audience interest. As a further convenience, the new barrel can be divided into two units. A performance can be made with each half.

Created originally by the Du Pont Petroleum Chemicals Division for Oil Progress Week observances, arrangements for "Magic Barrel" presentations are now handled by the OHC.

ASHLESS additive to help you curb oil burner ignition failures

You can now use a single additive to do two important jobs.

As a stabilizer and dispersant, Du Pont Fuel Oil Additive No. 2 does a highly efficient job of preventing sludge formations that cause filter fouling and nozzle plugging.

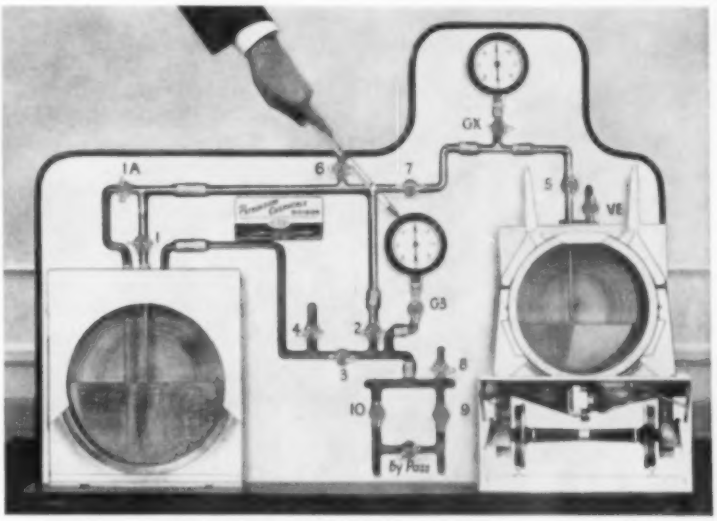
In addition, it offers an important plus value by minimizing ignition failures. How?

Being a nonmetallic *ashless* additive, it does not leave a metallic ash deposit which can foul the operation of the electrical system. Thus it helps to *eliminate many of the service calls* that cost your distributors time and money . . . and even loss of business through customer dissatisfaction.

Added to freshly prepared stocks at the refinery, FOA-2 retards the formation of insoluble residues during storage . . . keeps oil free flowing and clean burning . . . helps clean out sludge deposits that clog burner filters, screens and nozzles.

Many Du Pont contributions to safer, more efficient, TEL handling

Because the handling of tetraethyl lead is such a critical job, developing ways to do it safely and efficiently is a constant challenge. One of the main purposes of the Du Pont Petroleum Chemicals Division's operations group is to help refiners in this important work.



THIS HYDRAULIC WORKING MODEL exactly simulates with mercury the operation of a TEL eductor system . . . makes an ideal tool for training blending plant personnel.

By approaching the problem from different angles, Du Pont has been able to make a number of valuable contributions. One of these is . . .

New gage adaptation

Failure of the gage used in checking eductor efficiency during TEL blending is frequently costly to refiners in lost time and wasted manpower, as well as in the actual cost of repairs. This gage failure has often occurred when excessive pressure at shutdown or startup strains the gage, rendering it inaccurate or inoperable.

To correct this problem, we are providing a new type of gage that resists pressure damage. Its indicator needle is controlled by a grooved shaft. When the pressure limit – maximum pressure indicated on dial face – is reached, the needle and shaft disengage. When pressure drops, they automatically link together again – without damage to accuracy.

Large numerals on the gage face make it easy for operators to read pressures accurately within relatively close tolerances over the full range, both positive and negative.

Model helps in teaching

Another recent development of the operations group is a unique model of a blending plant which can be used as a working, visual training aid. Vacuum operated, it simulates actual blending plant operations. By presenting the

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

CONTINUED

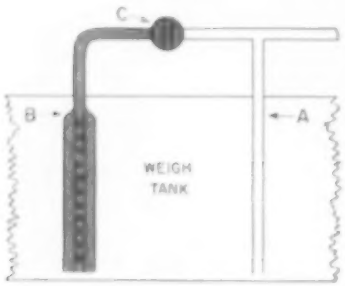
TEL Services

system as two simple mechanical functions – unloading and blending – it makes an ideal tool for giving new employees a graphic understanding of TEL handling operations. It can be used to demonstrate safety procedures and establish standard handling methods. And large groups can receive identical instructions at a single sitting.

Siphon problem ended

Until about a year ago, siphon breaks caused by leaks in the vacuum system often posed a serious TEL unloading problem for refiners. Then a Du Pont engineer in the operations group came up with the solution . . . and a special pipe that acts as a siphon starter was made available to refiners.

The Du Pont-designed siphon starter is entirely confined within the weigh tank. And the starter itself is surrounded by a perforated outer shield which eliminates any danger of explosion from a static charge.



THIS DIAGRAM EXPLAINS the basic principles in the Du Pont siphon starter system. "A" represents the standard standpipe. "B" indicates the perforated standpipe and shield. "C" is the siphon starter valve.

Metal-Flex hose

Still another Du Pont contribution to TEL unloading efficiency was the development of the Metal-Flex TEL unloading line. Because it is flexible, it does away with packing glands which sometimes result in leaks on other types of lines. The Metal-Flex hose requires only one man to hook up and operate.

Continued—middle of next column

Du Pont Metal Deactivator Now Approved for Use in Military Jet Fuels

A military specification, MIL-F-5624C, has been issued approving the use of metal deactivators in military aviation jet fuels. Du Pont Metal Deactivator, "DMD," complies with this specification.

In this new use, DMD protects against the harmful effects of active copper and other metallic compounds which have a detrimental effect on jet fuel stability. Its use is especially important for stockpiling and overseas operations where the storage periods and distribution lines are extra long.

Another important advantage of using DMD is the greater blending flexibility it provides. In this way, it increases substantially the availability of blending stocks that can be used for military jet fuels.

The government specification permits the use of a maximum of 2 pounds of active ingredient of metal deactivator per 1,000 barrels of jet fuel. Methods of addition and other information on the use of DMD are included in the recently published Du Pont Metal Deactivator book. If you do not have a copy, ask any of our representatives or regional offices to send you one.

Your special problems

Although we are not in the equipment design business, our operations group is always ready to help you with your individual TEL handling problems, *whatever* they are. And the above improvements are a result of this service, which also includes engineering help with blending plant design and construction – all the way from site selection to personnel training.

To help US . . .

continue to develop improvements in TEL handling, please tell us your problems. Just address your request for service to any of our representatives or regional offices listed below.

WEST COAST LAB MANAGER

JAY BRENT MALIN

A background as internal combustion engine specialist, work in rocket motor development, and engine research and development for The Texas Company qualifies J. Brent Malin for his current assignment. He is manager of the Petroleum Chemicals Division's Regional Laboratory at El Monte, California. Previous to this, he was a technical representative in the West Coast area.

Mr. Malin joined the Du Pont Company in 1951 as an automotive technologist. In that capacity he devoted much time to assisting oil companies in solving product use problems. With automobile manufacturers, he worked on engine developments related to fuel and lubricants.

Malin came to Du Pont from North American Aviation. Prior to that time, he had been with The Texas Company for ten years.

He was graduated from the University of Utah with a B.S. degree in mechanical engineering. He is a member of SAE and a Registered Professional Engineer, State of California.

DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • *Wilmington 98, Delaware*

Regional Offices:

NEW YORK, N. Y.—1270 Ave. of the Americas — Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave. — Phone RAndolph 6-8630
TULSA, OKLA.—P. O. Box 730 — Phone LUther 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. — Phone CApitol 5-1151
LOS ANGELES, CALIF.—612 So. Flower St. — Phone MAdison 5-1691

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division, 80 Richmond Street, West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-9995

Printed in U. S. A.

IS DESIGN IMPORTANT IN EXPANSION JOINTS?

The design of an expansion joint is, to Zallea Brothers, a vital matter. Not design aimed at lowering our production costs. Not design that attempts to provide a single cure-all for every problem involving joints. Zallea design is aimed at producing the best expansion joint possible to fill a specific set of requirements —design that gives the user a superior product and the very best possible service. Actual tests have proved Zallea Expansion Joints outlast all other packless joints. Performance records like this prove superior design and construction.

Zallea design engineers are always available to help solve expansion joint problems. The best help possible is as handy as your phone or mail box. And while you're at it, request Bulletin 351—our condensed catalog of standard types. It's free. And without obligation.

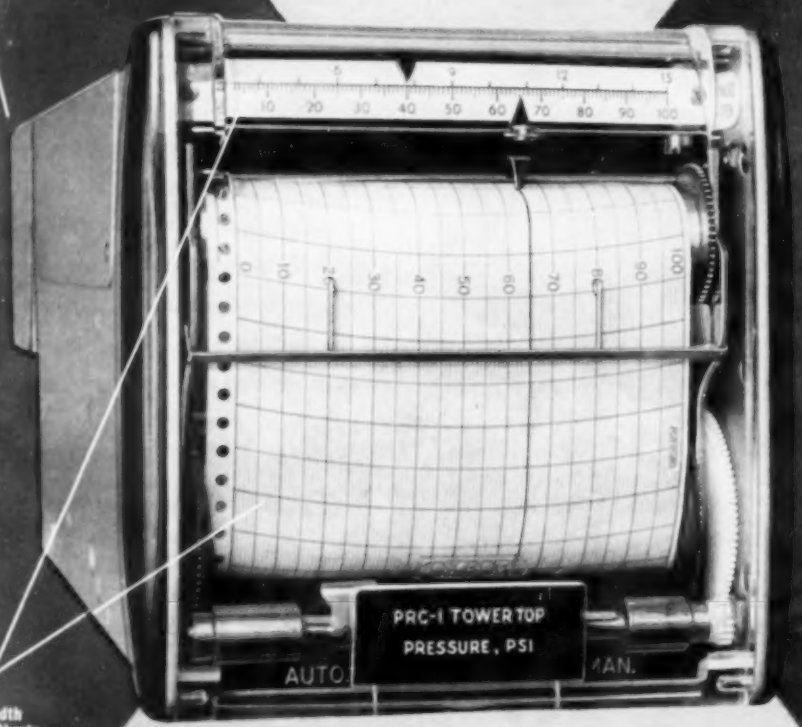
Zallea expansion joints

ZALLEA BROTHERS, 822 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

NOW...

compactness with nothing sacrificed!



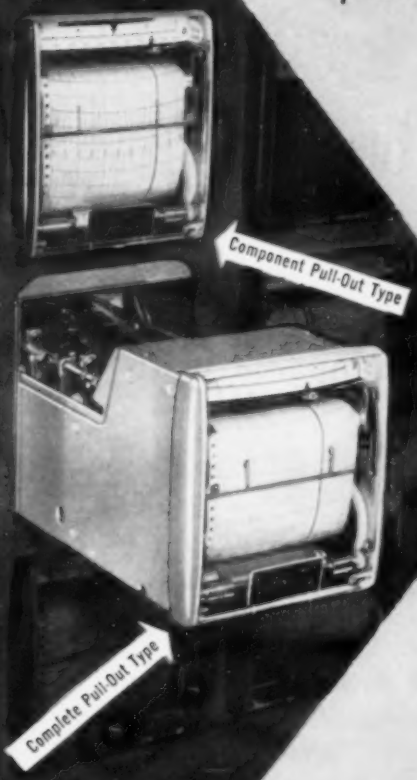
Models to Meet All Your Specifications

In all the following CONSOTROL instruments, recorder and indicator units can be easily converted in field.

- Recording Control Station with automatic/manual transfer
- Recording Control Station with manual loading only
- Recorder — single or two pen
- Indicating Control Station with automatic/manual transfer
- Indicating Control Station with manual loading only
- Indicator — single or two pointer

CONSOTROL

small-case panel instruments



Here's the "tops" in centralized recording and control efficiency! CONSOTROL* Instruments require the minimum of valuable panel space, yet provide unsurpassed operator convenience, visual accuracy, and ease of maintenance . . . maintain the highest standards of precision and dependability. For example: the simple CONSOTROL method of switching from automatic to manual control requires no memory or extra operations . . . never "bumps" the process. All CONSOTROL charts and scales are full 4-inch width for greatest visibility . . . highest accuracy. When it comes to servicing, there's plenty of "finger room" . . . all parts are uncrowded and easily removable. And just compare inking requirements with other designs. CONSOTROL needs ink filling only once or twice a year! These are only a few of CONSOTROL's advanced design features — available in both fixed-mounting and full pull-out type instruments. Get the complete story. Write for Bulletin 13-18. The Foxboro Company, 919 Neponset Avenue, Foxboro, Mass., U.S.A.

*Reg. U.S. Pat. Off.

FOXBORO

REG. U.S. PAT. OFF.

Consotrol Process Control

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

HAUNTED by departed PEP from your motor fuel?

BLENDING WARREN NATURAL GASOLINE WITH YOUR PRESENT HIGH QUALITY MOTOR FUEL WILL GIVE IT . . .

RETAINED VOLATILITY

(in every season)

You can depend on WARREN'S production, transportation, storage and service for the grade and quantity of NATURAL GASOLINE you want — where and when you want it.

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

EC&M Bulletin 1062 Type ZHS 2300-volt Motor Starter in Type VIII enclosure for Class I, Group D hazardous atmospheric locations.

Motor Starters

2200 TO 5000 VOLTS

HELP BOOST PETROLEUM PRODUCTION

● For maximum protection in hazardous locations, all connections, terminals and arcing parts of these Type ZHS Motor Starters are oil-immersed. In addition, oil-immersion keeps the mechanism thoroughly lubricated and protected against corrosion . . . eliminates the need for frequent inspection or maintenance.

These motor starters have self-contained, adjustable overload relays with inverse-time-element feature which protects motors from overheating as a result of overload, loss of one phase or failure to start. Of combination type, these relays assure instantaneous trip on heavy overloads or short circuits.

EC&M Type ZHS Starters for 2200 to 5000-volt motors are built in 50,000 KVA interrupting capacity and in the VALIMITOR (volt-ampere-limitor) style for use on power systems having infinite KVA.

Throughout the petroleum industry, EC&M Motor Starters are providing continuous safe service . . . helping to boost petroleum production.

Write for Booklet 1062 describing EC&M 2200-5000-volt motor starters

THE ELECTRIC CONTROLLER & MFG. CO.

4498 LEE ROAD • CLEVELAND 28, OHIO

Grace Chemical Company Selects an *Air Products* INCORPORATED AIR SEPARATION PLANT

GRACE CHEMICAL COMPANY

March 1, 1955

Mr. C. R. Anderson, Vice President
Air Products, Incorporated
P. O. Box 538
Allentown, Pennsylvania

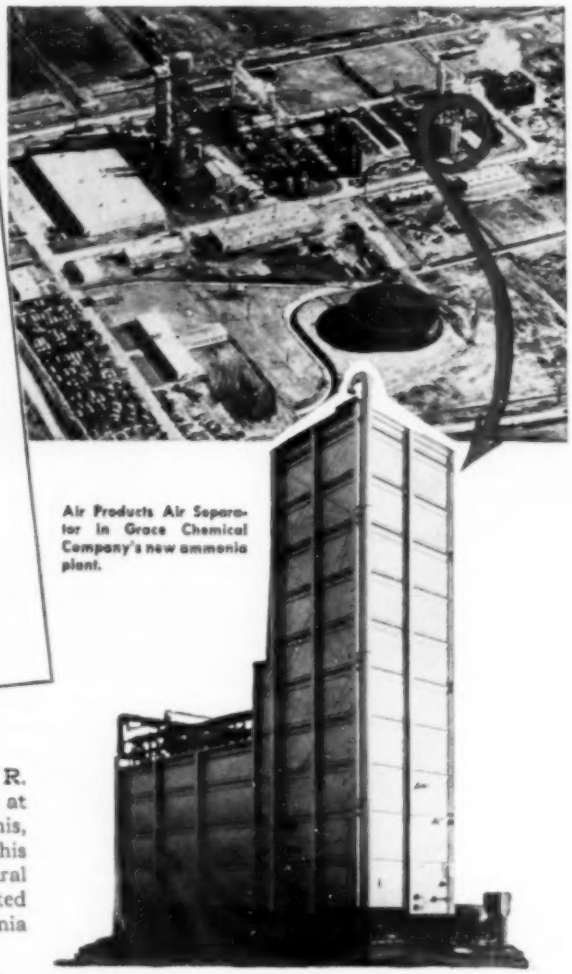
Dear Mr. Anderson:

The Grace Chemical Company's new anhydrous ammonia-urea plant at Memphis, Tennessee has been "on-stream" now for some time. The successful operation of the equipment is in no small part due to the manner in which the air separation unit has functioned.

The low-temperature equipment supplied by your company was erected under the supervision of your engineering staff with a very minimum of difficulty. The presence of your men during the plant "shake-down" period contributed greatly to our starting production with less delay than normally is to be expected on a project of this size.

Very truly yours,
GRACE CHEMICAL COMPANY
W. P. Gage

WPGage



Air Products Air Separator in Grace Chemical Company's new ammonia plant.

Grace Chemical Company, subsidiary of W. R. Grace and Company, has started operations at its new anhydrous ammonia-urea plant at Memphis, Tennessee. The new plant was constructed to put this century-old firm into the relatively new agricultural chemical field on a large scale. Production is expected to exceed the rated capacity of 90,000 tons of ammonia and 54,000 tons of urea annually.

An important unit in the process is the air separation plant designed and built by Air Products, Inc. to split air into nitrogen and oxygen. Air Products has built over 700 air separators which are being operated successfully throughout the world.

Satisfaction, from the initial inquiry to the successful operation of the plant, is assured when your low-temperature processing work is entrusted to Air Products.

If your project calls for gas separation by low-temperature processing, get in touch with us.

36-page brochure discusses the broad possibilities of low-temperature processing and describes Air Products' facilities. Write for a free copy.

Air Products INCORPORATED

Dept. L, Box 538, Allentown, Pa.

Specialists in Low-Temperature Processing

Unibestos® keeps 1175° where it belongs

Catalytic cracker...vacuum still and "poly" plant—all get added protection against heat loss with strong, single-layer Unibestos Pipe Insulation.

And Unibestos starts cutting costs right at the beginning. Unibestos, made of African Amosite, is easy to handle, easy to cut and miter. Long, interlacing fibers assure positive heat seals between sections...reduce pointing of joints...simplify insulation of fittings.

Built to resist thermal shock, vibration, and unaffected by most acid and chemical fumes, Unibestos can be easily removed and effectively reapplied when lines are relocated or replaced.

Standard Production Sizes

Unibestos Pipe Insulation is regularly made in 3-foot lengths for pipe sizes from ½" through 24", in standard thicknesses through 5". Unibestos Block Insulation is made in 6", 12", 18" or 36" widths and in thicknesses from 1" through 3" in ½" increments.

For complete information, write for descriptive Bulletin 109C

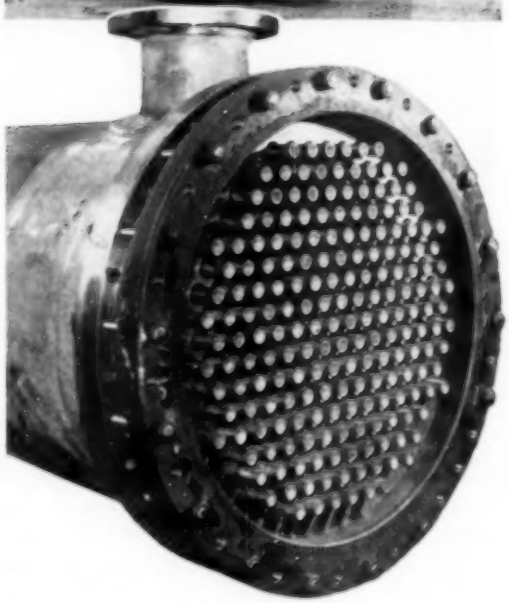
UNARCO®

UNION ASBESTOS & RUBBER COMPANY

1111 West Perry Street • Bloomington, Illinois

"Pack Off Your Troubles..."

SPENCER®



THE PROBLEM: One of Spencer Chemical Company's plants needed an air preheater to handle nitrogen gases at 1600°F. on the tube side, against air at 550°F. on the shell side. These widely different temperatures produced a 2" differential expansion between tubes and shell.

ENGINEERING: Western heat transfer engineers considered several possible solutions: a) An expansion joint in the shell; b) Individual tube packing; c) A packing gland in the shell.

CONSULTATION: These approaches were discussed with the Spencer engineers. After mutual examination of plant design problems, the individual tube packing method was chosen. Upon completion of the precision fitting and welding there was adequate room for expansion and contraction of the tubes within their individual packing glands.

IMPORTANCE: The Spencer Chemical Company job typifies Western's capabilities in working *with* the client to satisfactorily solve the specialized engineering and fabricating problems of today's high temperature, high pressure services.

WESTERN
HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

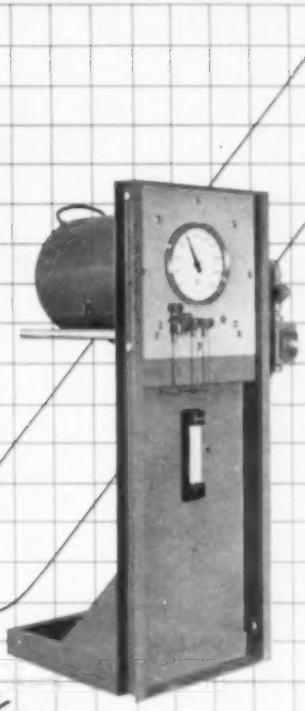
P. O. BOX 1889 • TULSA, OKLAHOMA

HUDSON-RUSH COMPANY—753 Gladstone Blvd., Shreveport, La.
130 Casa Linda Plaza, Dallas 18, Texas
PROCESS INSTRUMENTS & EQUIP. CO. - North Bldg., Charleston, W. Va.
H. W. SEVERANCE—Marion E. Taylor Bldg., Louisville, Ky.

throughput up

quality up

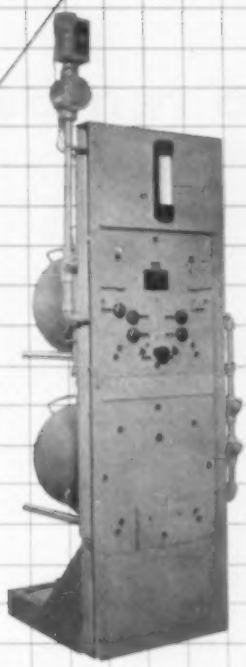
costs down



process refractometer

(Type 38-201)

Monitors or automatically controls a process stream by *continuously* comparing its refractive index (the measure of the velocity of light through the test fluid compared to its velocity through a vacuum) with the index of a sample of *desired* composition. SEND FOR BULLETIN CEC 1839-X12.



infrared analyzer

(Type 38-101)

Handles up to five streams at a rate of 5 analyses per hour, i.e., 12-minute cycle. Increases fractionator capacity by minimizing fluctuations and holding product composition steady. Eliminates the time lag inherent in sampling and batch analysis. SEND FOR BULLETIN CEC 1840-X12.

Here are the first "Consolidated-Phillips" *continuous* process analyzers . . . units which provide analytical data while it's valid, *before* variables have changed. With these two instruments on stream, product quality and production go up . . . costs go down. You can install and maintain them for less, on an hourly basis, than a laboratory technician's salary. Both instruments are completely explosion- and weather-proof.

Consolidated-Phillips process analyzers have been proving their ability . . . and dependability . . . under actual plant conditions for several years. Originally designed and formerly manufactured by Phillips Petroleum Company, they are now backed by Consolidated Engineering's nationwide service organization . . . assurance of interruption-free operation for years to come at the pace demanded by modern refinery practice.

Whether your process instrumentation needs are for a single unit or a complete analysis-and-control system, you'll find it will pay to talk to a CEC Field Engineer. Write us today.

Consolidated Engineering

Corporation

Sales and Service Offices Located in Albuquerque, Atlanta, Boston, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, San Francisco, Seattle, Washington, D.C.

ELECTRONIC INSTRUMENTS
FOR MEASUREMENT AND CONTROL

300 North Sierra Madre Villa,
Pasadena 15, California

to remove

H_2S

CO_2

use

Monoethanolamine

Diethanolamine

high purity
NITROGEN DIVISION
chemicals

Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

Call or write today for samples and quotations. Ask too for technical service to help adapt these high purity chemicals to your process.

NITROGEN DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Hopewell, Va. • Ironton, Ohio • Orange, Tex. • Omaha, Neb.

to remove

H_2O

use

Diethylene Glycol

Triethylene Glycol

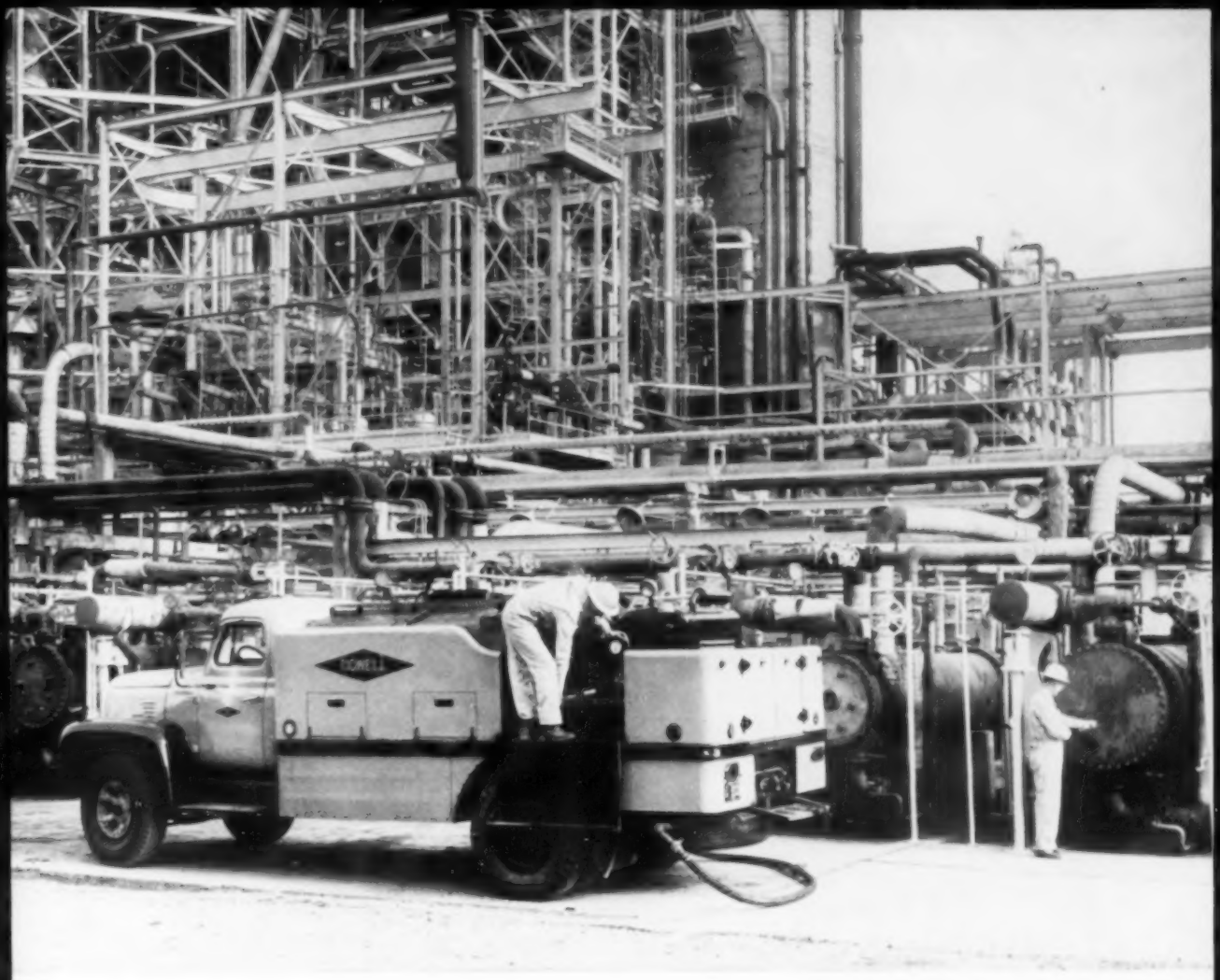
high purity
NITROGEN DIVISION
chemicals

Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

Call or write today for samples and quotations. Ask too for technical service to help adapt these high purity chemicals to your process.

NITROGEN DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Hopewell, Va. • Ironton, Ohio • Orange, Tex. • Omaha, Neb.

Anhydrous Ammonia • Ammonia Liquor • Ammonium Sulfate • Sodium Nitrate • Methanol • Urea
Ethanolamines • Ethylene Oxide • Ethylene Glycols • Formaldehyde • Nitrogen Tetroxide
Nitrogen Solutions • U.F. Concentrate—85 • Fertilizers & Feed Supplements



While the cat cracker remained in full operation, DOWELL cleaned six slurry exchangers chemically . . .

UPPING THROUGHPUT 900 BPD

No cat cracker operator wants to see his throughput go down. Neither did this one. Nor could he afford to wait for the annual shutdown to give six slurry exchangers the cleaning they obviously needed *fast*. His solution? Call Dowell to remove the scale deposits with chemicals.

Dowell engineers devised a procedure for cleaning the exchangers *with the cat cracker in full production*. The exchangers were cleaned by Dowell one at a time, while the remaining five units carried the load.

As a result of chemical cleaning, the operator reported a jump in throughput of *900 barrels per day* . . . plus an average increase of 26° in the heat co-efficient of the exchangers.

Dowell Service is designed to restore *your* equipment to top efficiency—and do it *fast*, with the very minimum of costly downtime. Experienced Dowell engineers do the job for you. They bring all the necessary chemicals, pumps and control equipment right into your plant. Solvents are introduced through regular connections, holding dismantling to a minimum.

For full information on a program of Dowell chemical cleaning for *your* plant, call your nearest Dowell office. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. I-32.

chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

. . . OF SOUP, SACCHARIN, AND SUDS

What's in a drop of oil? Petroleum chemistry has found the answer to be without limits.

With petrochemicals, great strides have been made in producing better insecticides and pesticides, thereby enhancing the world's food supply. Petrochemicals brought about the successful synthesis of pharmaceutical compounds, making possible the mass production of life-saving drugs. New building materials . . . synthetic fibers and detergents . . . all of these are the results of continued research in the field of petrochemicals.

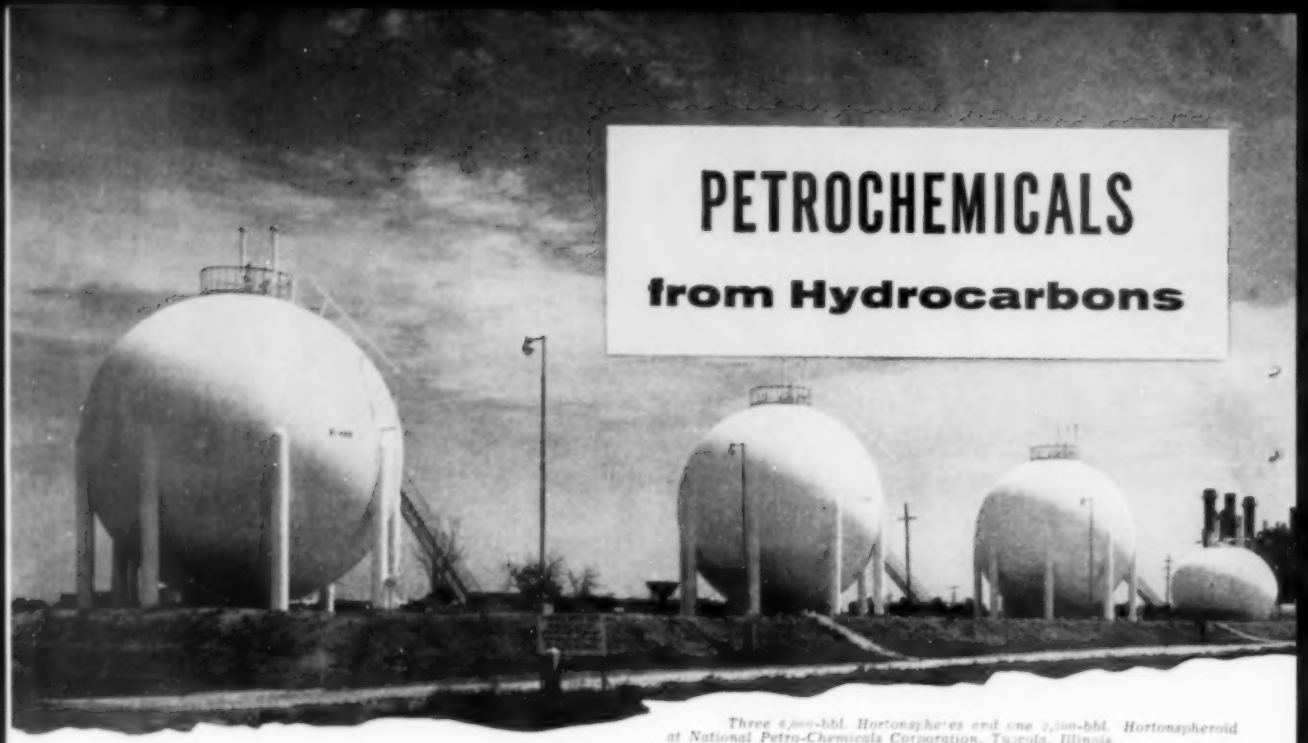
To make a great part of these successes possible required from petroleum sources the availability of large quantities of high purity benzene, toluene, and xylenes. These aromatics are now produced in exceptionally high purity and large amounts by the UOP Platforming process and are separated by the Udex process, this latter process developed cooperatively by Dow Chemical Company and Universal Oil Products Company and engineered and licensed by UOP. With these processes a ready supply of aromatics will always be assured.

Unheard of only a short time ago, these developments have become just the beginning for an unlimited future.

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

UOP *Universal Service Protects Your Investment*



PETROCHEMICALS
from Hydrocarbons

Three horton-bbl. Hortonspheres and one 2,500-bbl. Hortonspheroid at National Petro-Chemicals Corporation, Tuscola, Illinois.

. . . another job that demands expertly engineered tanks and towers

. . . and CB&I has complete facilities to engineer, fabricate and erect them all. Four strategically located plants can provide solid, lined or clad steel structures built to the most exacting specifications. The towers, Hortonspheres® and Hortonspheroid® shown here, built for that brawny "infant" industry of petrochemicals, were fabricated and erected by CB&I for J. F. Pritchard Company and the Lummus Company and are located at the National Petro-Chemicals Corporation, Tuscola, Illinois.

Write our nearest office for further information on expertly engineered steel plate structures by CB&I . . . from tanks to towers.

A 6½-ft. diam. by 73-ft. stripper tower.

B 5½-ft. diam. by 88½-ft. absorber tower.

C 6½-ft. diam. by 20-ft. accumulator tanks.

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

In seven of these tanks at this Lehigh Warehouse & Transportation Company terminal at Bayonne, New Jersey, a blanket of DRY *air can be maintained to prevent contamination of their contents by moisture.*

◀ Type BY Lectrodryer for DRYING compressed air.

DRY air blankets products stored at this terminal awaiting trans-shipment

Tank cars arriving at this terminal are washed out with steam and then flushed with compressed air until they're dry. Thus they make certain there'll be no contamination of materials being loaded into these cars.

To safeguard any products stored here which would pick up moisture from the air above them, the tanks are kept flooded with DRY air at 30-pounds pressure. This positive pressure inside the tanks prevents infiltration of moist air from the outside. Product quality is preserved.

A Lectrodryer dries air as it comes from the compressors at 100-pounds pressure and feeds it to the storage tanks. Completely automatic, its DRYing-regeneration cycle is reversed every three hours to keep it working at top efficiency.

Whatever your DRYing problem—air, gases or organic liquids—there's a Lectrodryer capable of handling it. The book, *Because Moisture Isn't Pink*, describes installations in dozens of industries. For a free copy, write Pittsburgh Lectrodryer Corporation, 332 32nd Street, Pittsburgh 30, Pa.

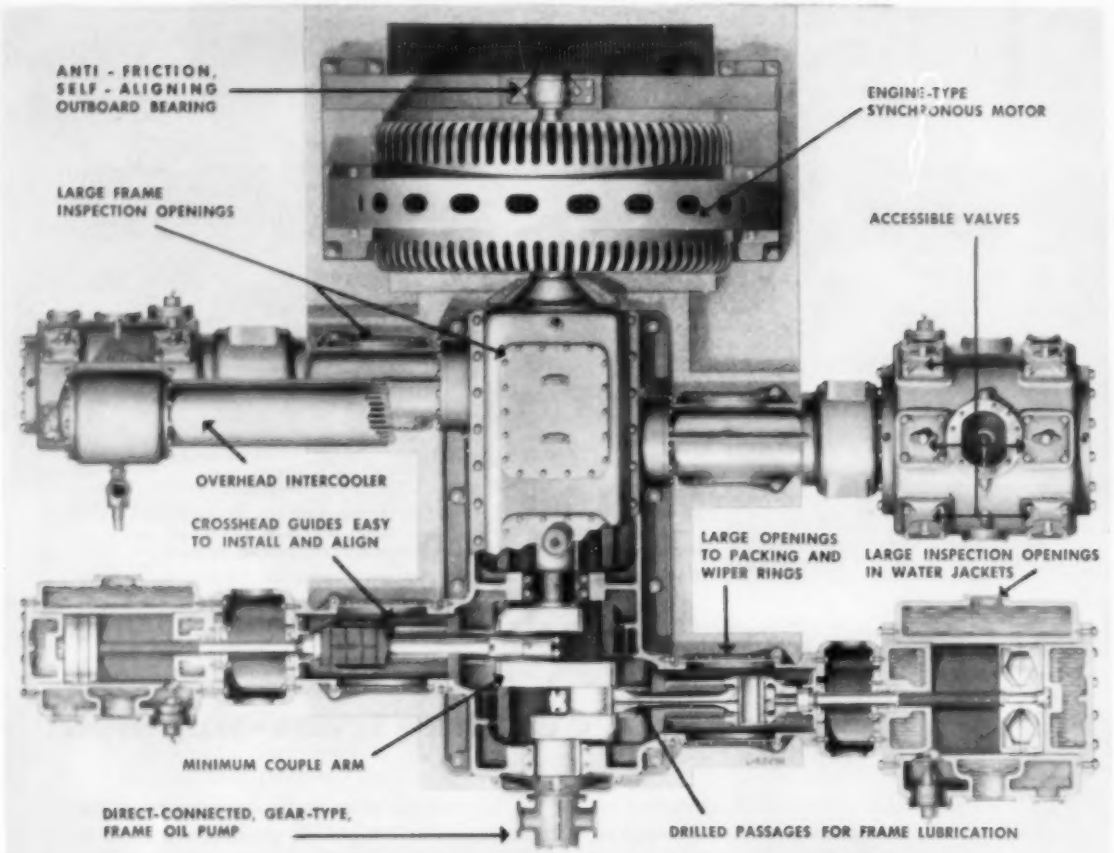
In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S.A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

LECTRODRYER

® REGISTERED TRADEMARK U. S. PAT. OFF.

Worthington Balanced Gives LOWEST OPERATING


ANTI - FRICTION, SELF - ALIGNING OUTBOARD BEARING
ENGINE-TYPE SYNCHRONOUS MOTOR
LARGE FRAME INSPECTION OPENINGS
ACCESSIBLE VALVES
OVERHEAD INTERCOOLER
CROSSHEAD GUIDES EASY TO INSTALL AND ALIGN
LARGE OPENINGS TO PACKING AND WIPER RINGS
LARGE INSPECTION OPENINGS IN WATER JACKETS
MINIMUM COUPLE ARM
DIRECT-CONNECTED, GEAR-TYPE, FRAME OIL PUMP
DRILLED PASSAGES FOR FRAME LUBRICATION

CUTAWAY OF FOUR CYLINDER BALANCED OPPOSED COMPRESSOR. Just one of the many multi-service cylinder arrangements available. Option of drivers gives full freedom in choice of power or fuel for maximum economy and convenience. Available drivers include: direct-connected engine-type synchronous motor *(shown)*; steam turbine through reduction gear; special induction motor; or direct-coupled internal combustion engine. Red areas show lubrication coverage.

"Easier to inspect and maintain than any similar compressor." That's what engineers say about the Worthington Balanced Opposed Compressor.

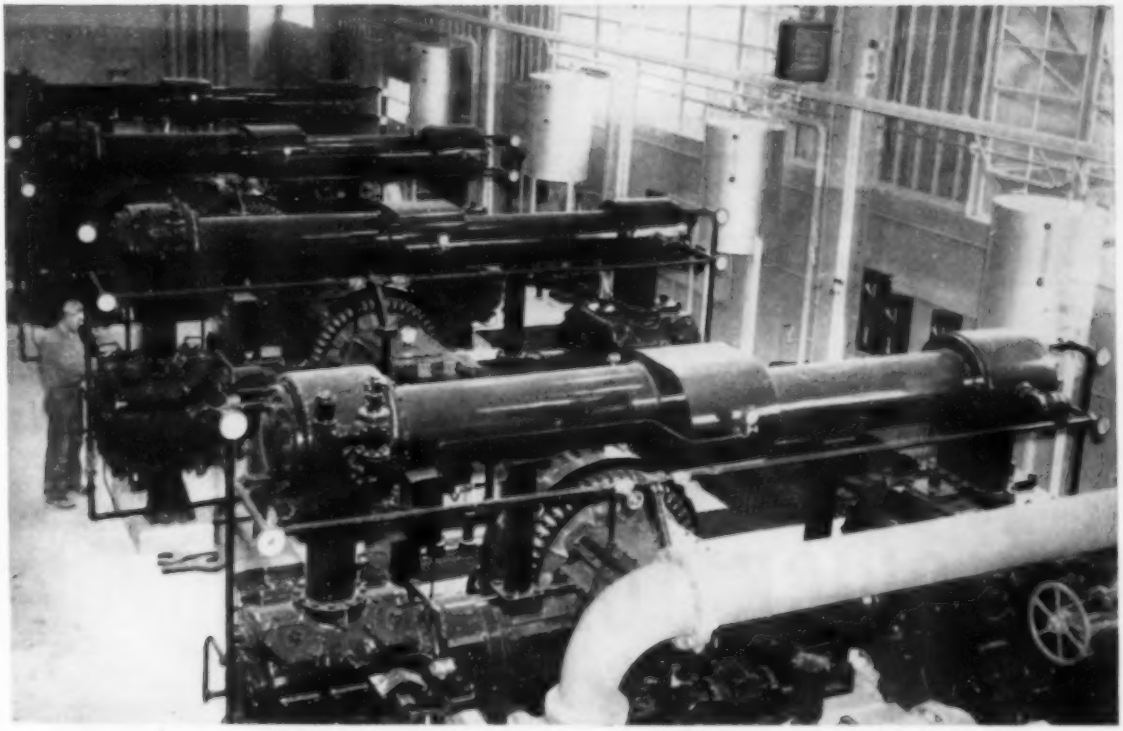
LARGE ACCESS OPENINGS are provided for inspection and maintenance of piston rod packing, oil wiper rings, water jacket, main bearings, crossheads, and crosshead guides. All valves are accessible and easily replaced. This easy accessibility of working parts facilitates *preventive* maintenance, reduces downtime for *corrective* maintenance.

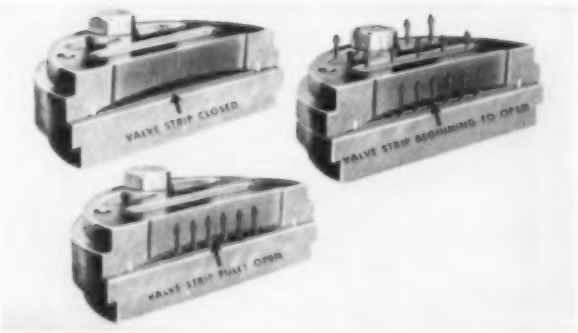
REDUCED INSTALLATION COSTS because foundations can be smaller. Inertia forces developed in one cylinder are bucked and largely cancelled out by similar and opposite forces developed in the opposing cylinder. Only a relatively small turning force, or couple is transmitted to the foundation. As a result, foundations are smaller for the balanced opposed than for equally rated compressors of other designs.

MAXIMUM STRENGTH, MAXIMUM STABILITY, result from the rugged one-piece-cast main frame and most stable construction of any similar compressor. Main bearing supports are integral with frame and reinforced with heavy steel tie bars over each bearing. Keyways in frame seat each tie bar and lock it in place, permanently preserving alignment.

AVAILABLE SIZES AND TYPES range from 300 to 10,000-hp with pressures from vacuum to 35,000 psig. A few applications include (figures indicate orders of magnitude only): *dry vacuum pumps* operating at very low pressures, *standard shop air compressors* (125 psig), *refrigeration gas compressors* (250 psig), and *multi-stage gas compressors* for use in service such as ammonia synthesis, methanol and hydrogenation plants (3500 to 35,000 psig). For more information, write for Bulletin L-679-B1 on company letterhead. Worthington Corporation, Section K.5.2, Harrison, New Jersey.

Opposed Compressor Design and MAINTENANCE COSTS





COMPRESSED AIR for Ford plant in Mahwah, New Jersey, is supplied by this array of four 450-hp, 100 psig Worthington Balanced Opposed Compressors.

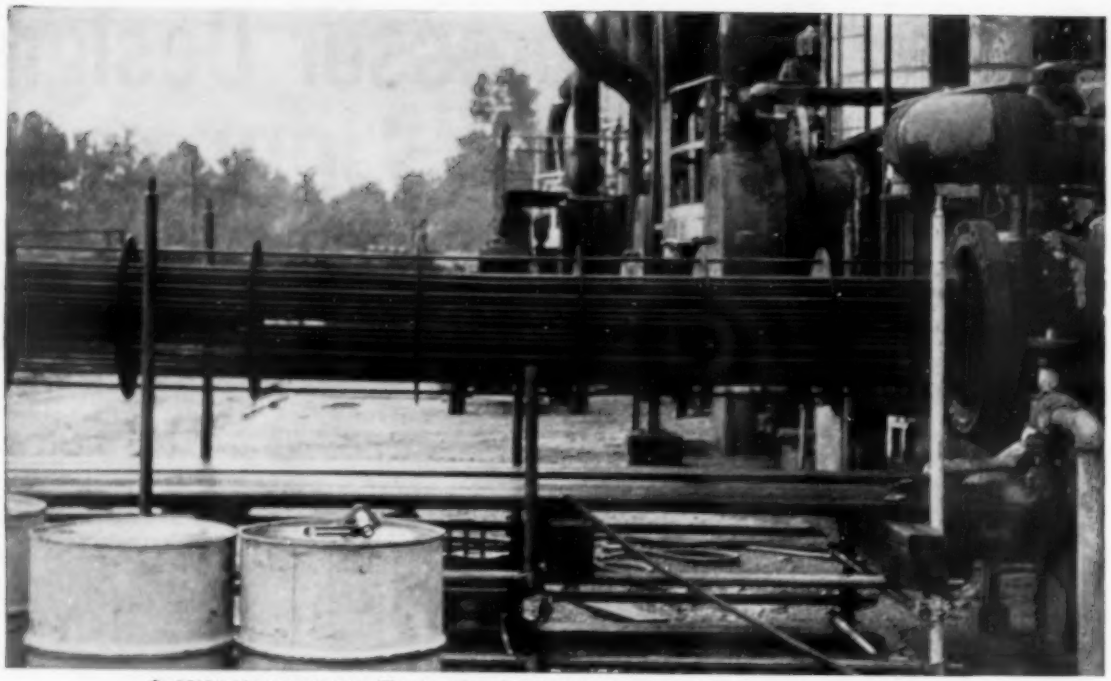
HIGH-SPEED, LOW INERTIA Worthington Feather® Valve contributes to quiet operation and easy maintenance of Worthington Balanced Opposed Compressor. Thin, flexible strips of stainless ribbon steel form active elements. Curved guards hold strips in position over rectangular openings. Strips lift and flex uniformly against guards. Absence of impact results in quiet operation, longest valve life and low maintenance costs.

WORTHINGTON

K-5-2

Only Worthington Compressors give you Feather Valve Performance

Y-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors



READY FOR INSPECTION—This bundle, which had been protected by Polyrad corrosion inhibitor, was pulled for inspection as part of the regular maintenance program.

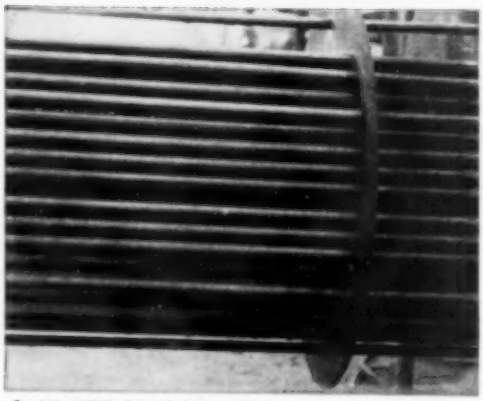
QUICK TURN-AROUND

Turn-around Time no longer need be headache time—not when Polyrad costs so little.

An average treatment is about 1 quart of Polyrad corrosion inhibitor per 1,000 barrels of fluid. That's all it takes to prevent excessive down time for cleaning or replacing fouled and corroded refinery equipment.

Polyrad's detergent action is so powerful that in many cases fouled equipment can be cleaned up while in operation. Organic and inorganic deposits don't have a chance to collect in Polyrad-protected equipment. They are quickly loosened and removed in the fluid stream. That's why all around the refinery, Polyrad helps maintain throughput, increases heat transfer, and cuts down time for maintenance.

Stocks of Polyrad are maintained throughout the country. A Hercules technical representative will be glad to discuss its application to your specific operating conditions.



NO NEED TO REPLACE—Polyrad corrosion inhibitor had done its job well, as this close-up shows. Still clean and free of corrosion, the bundle was returned to service immediately.

Pine Chemicals Division,
Naval Stores Department
HERCULES POWDER COMPANY
INCORPORATED
984 King Street, Wilmington 99, Del.

POLYRAD®
FILMING AMINE INHIBITOR

NASS-3

Groceries . . . miracle of BRICK

Colorful cans, gleaming bottles, eye-catching cartons riding in the cart—not a single one of them would be there were it not for refractory brick. Brick that makes steel. Brick that makes glass. Brick that makes paper.

Everything that's made and everything that's moved starts with refractory brick in one form or another, lining the furnaces of industry. The requirements are almost infinite in variety.

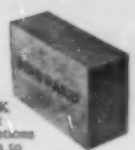
To provide the truly complete refractory service that industry needs, General Refractories employs the world's largest refractories research laboratory; brings materials across oceans; manufactures in plants strategically located to serve industry swiftly . . . dependably . . . economically . . . everywhere.

GENERAL REFRACTORIES COMPANY, Philadelphia 2

A COMPLETE REFRACTORIES SERVICE

FOR THE GLASS INDUSTRY . . .

RITEX—Unburned basic brick—in magnesite, magnesite-chrome, and chrome-magnesite. More resistant to spalling. Lower porosity, lower thermal conductivity—high hot strength.



GREFCO SILICA BRICK are available at convenient locations from California to Pennsylvania. Glass men know there is no finer product. No more dependable supply.

OLIVE HILL—An exceptionally strong and dense fireclay brick—true to size and shape.

GENERAL REFRACTORIES

YORKMESH

DeMISTERS

Assure clean separation between vapor and liquid

Yorkmesh Demisters—by effecting clean separation between vapor and liquid—improve the performance and increase the throughput capacity of any process vessel handling both liquid and vapor phase materials.

Yorkmesh Demisters are knitted wire mesh pads, available in a variety of types, sizes and materials. The unique fine wire construction provides flexibility, resiliency, light weight, high structural strength and extensive surface area. These Demisters are supplied to the exact size and shape required and are usually furnished mounted on light weight open type support grids. Installation is simple in both new and existing equipment.

Vapor-liquid separation efficiency with Yorkmesh Demisters in process vessels is always very high, usually in excess of 99.9%. Where Yorkmesh Demisters are installed in evaporators, distillation columns, gas filters and absorbers, liquid entrainment is substantially completely eliminated.

Pressure drop is so low that it is nearly always negligible. At atmospheric pressure vapor velocities between 2 and 12 ft./sec. are recommended. Under vacuum, depending on conditions, vapor velocities of 30 ft./sec. and higher are possible.

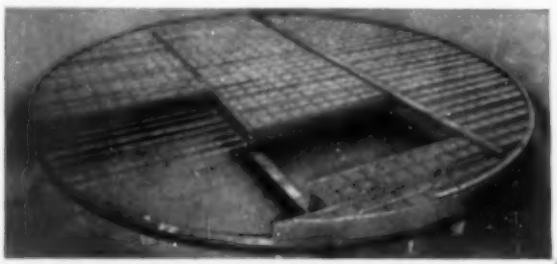
Yorkmesh Demisters are fabricated in a wide variety of materials, densities and wire mesh constructions which are selected to give best performance for the particular operating conditions.

Yorkmesh Demisters are available for prompt delivery in the following materials:

Types 304, 316, 317, 410 and 430 stainless steel
Monel, nickel, Inconel
Aluminum (56-S wire alloy)
Low carbon steel, copper, brass
Also available in Carpenter 20 stainless,
Hastelloy B & C, tantalum etc.

The wide experience of the Otto H. York Co., Inc. with thousands of demisters in service provides a sound basis for recommendations that assure the most economical and efficient type of demister for each application. Call on York to solve your problems in vapor-liquid separation.

Complete catalog and list of technical literature (TL54) free on request.



SECTIONAL CONSTRUCTION—recommended for large vessels and for all applications requiring installations through a manhole.

ONE-PIECE CONSTRUCTION—recommended when installation can be made through end of vessel.

Increase throughput capacity!
Improve process efficiency!
Improve overhead quality!
Reduce contamination!
Stop costly liquid loss!

Yorkmesh Demisters are being used successfully in all types of process vessels handling both liquid and vapor phase materials. Some typical examples—

VACUUM TOWERS:
To increase throughput and improve quality of gas oil by separating entrained asphalt. To decrease metals contamination of gas oil. To improve quality of lube distillates.

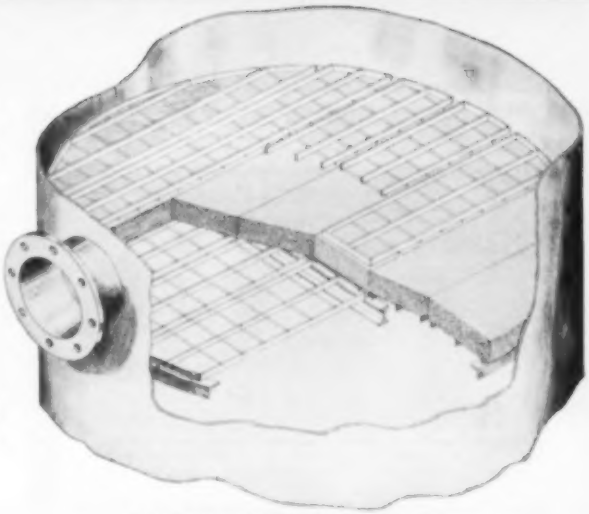
DISTILLATION:
To remove entrained liquid fatty acids from fatty acid vapors. To improve quality of organic product while increasing production. To eliminate glycerin losses.

FLASH TOWERS:
To recover clean naphtha from asphalt solutions. To separate propane from asphalt.

ABSORBERS:
To remove absorption oil from natural gas. To prevent loss of glycol and amine solutions.

EVAPORATORS:
To produce high purity steam from concentrated caustic soda solutions. To stop entrainment losses from valuable fluoride solution.

KNOCK-OUT DRUMS:
To remove water and oil from air. To remove fatty acids from superheated steam. To reduce compressor maintenance by removing liquid entrainment from the gas.



SECTIONAL TYPE DEMISTER IN PLACE—cutaway view.

STEAM DRUMS:
To eliminate liquid entrainment in order to produce high quality, high purity steam.

GAS FILTERS:
To clean manufactured gas. To separate sulfuric acid and solids from chlorine gas.

COMPRESSORS:
To separate entrained liquids from compressor discharge gasses.

SCRUBBERS:
To separate water from natural gas. To eliminate mist from flue gas. To remove natural gasoline from natural gas.

HOW TO GET THE BEST PERFORMANCE—

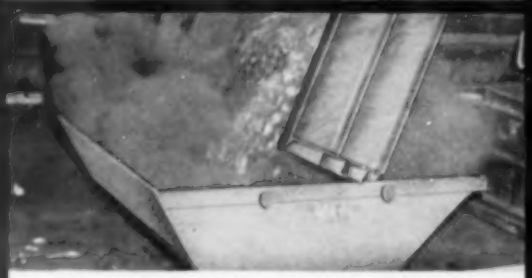
Send us details on type of process vessel or operation (absorber, vacuum tower, evaporator, knock-out drum, etc.); vapor flow rate, pressure, temperature, and density or molecular weight; liquid rate, viscosity, and specific gravity; for existing equipment advise dimensions, indicate vertical or horizontal vessel, and material of construction required. Furnish a drawing or sketch if possible. Complete details will enable us to make a precise recommendation and price quotation.

YORK

OTTO H. YORK CO., INC.
6 CENTRAL AVE. • WEST ORANGE, N. J.
"clean separation between vapor and liquid"

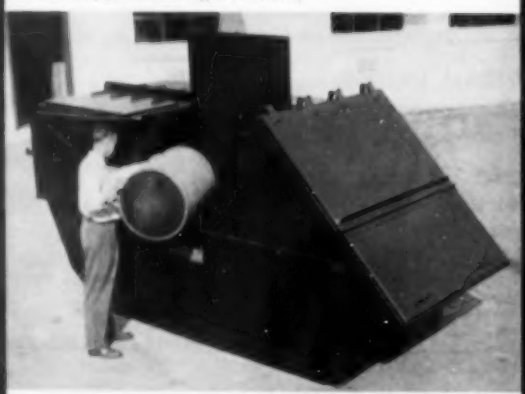
COLLECT IT

AS IT ACCUMULATES — SOLIDS, POWDERS, SLUDGE, LIQUIDS
RAW MATERIALS, FINISHED PRODUCTS, WASTE MATERIALS



Heavy waste is dumped into an open container at a foundry in New York. The first step in the LOAD LUGGER SYSTEM of materials handling is to place a number of containers at strategic points to collect material as it accumulates, reducing handling at the point of origin.

Light material accumulates in an open container with high sides at a shipping carton plant in Louisiana. Rugged LOAD LUGGER containers are built of welded steel, have deep leak-proof bottoms, hold from 1½ to 14 cubic yards and more, and handle all types of material.



It is easy to load this 14-cubic-yard LOAD LUGGER container of a St. Louis contract hauler. It fills to the top without raking and is wind-proof and rat-proof. A model with rubber seals and latches is also theft-proof, fly-proof, dust-proof, and almost odor-proof.

PICK IT UP

ALREADY LOADED — NO LOST TIME AND NO LOADING CREWS
LET ONE TRUCK AND DRIVER DO IT ALL — REPLACING MANY

A full container is picked up at a refinery in Indiana. The second step in the LOAD LUGGER SYSTEM is for one driver and his truck equipped with a hoist-body to pick up full containers on a regular schedule. This procedure does away with lost time and loading crews and eliminates the need for several conventional trucks and their drivers.

A bearing manufacturer in Ohio picks up a full container of dolomite. LOAD LUGGER hoist-bodies (flat-bed truck bodies with a pair of hydraulic-powered hoisting arms) handle pay loads of up to 18,000 pounds and more. They are easily mounted on any truck chassis of suitable capacity, and all controls are installed in the cab.

An open container used for accumulating industrial wastes is picked up by a Chicago contract hauler. For greater safety, LOAD LUGGER hoist-bodies lift containers with four-point suspension and have double-acting hydraulic cylinders for positive control at all times.

LOAD LUGGER®

ENGINEERING B-W PRODUCTION

• FLAT-BED TRUCK BODIES WITH HYDRAULIC HOISTING ARMS
• LEAK-PROOF TILT-DUMP CONTAINERS FOR BULK MATERIALS

HAUL IT

IN MANY TYPES OF CONTAINERS — OR ON THE TRUCK BED IN PLANT AND OVER THE ROAD — ON YOUR TRUCK CHASSIS

A city truck in Ohio hauls a full container of repair materials. Government approval is evidenced by the many such municipal, state, and federal installations. Hauling full containers is the third step in the LOAD LUGGER SYSTEM, and over-the-road hauls are as feasible as in-plant because of the use of standard truck chassis.

A full container of residue materials is hauled at a corn products processing plant in Illinois. LOAD LUGGER hoist-bodies carry containers well forward for correct load distribution and cradle them between steel sidewalls for greater travel safety.

LOAD LUGGER hoist-bodies also carry materials or equipment directly on their flat beds, loading and unloading heavy objects with their hoisting arms.

This special hoist-body of a Michigan telephone company transports heavy cable reels. Such new uses for LOAD LUGGER equipment are constantly being developed.

DUMP IT

BY TILTING CONTAINER VERTICALLY OVER REAR APRON, OR DELIVER IT BY EXCHANGING FULL CONTAINER FOR AN EMPTY

Spent solvents are dumped into incinerator tank at a drugs and medicines manufacturing plant in Michigan. Delivering full containers or dumping their loads is the fourth step in the LOAD LUGGER SYSTEM. Returning empty containers then completes the cycle.

Metal scrap is dumped and spread in the yards of a scrap metals service company in Iowa. LOAD LUGGER hoist-bodies handle more pay load on a given truck chassis, because they are lighter than comparable equipment. And their patented simplicity, clean design, and sturdy construction make them cost less to buy and maintain.

Equipment of a Miami contract hauler in the dumping position. The LOAD LUGGER hoist-body has outrigger jacks to protect rear springs and axles from injury while picking up and putting down heavily loaded containers, but it neither needs nor uses these jacks while tilting container over rear apron to dump or spread the load.

ENGINEERED, MANUFACTURED, AND MARKETED BY BROOKS EQUIPMENT & MFG. CO., SUBSIDIARY OF

BORG-WARNER

CORPORATION — DISTRIBUTED INTERNATIONALLY

BROOKS EQUIPMENT & MFG. CO.
2061 Davenport Rd., Knoxville, Tenn.

For more information mail this coupon to:

Name and position

Name of company

Street address

City, zone, state

DON'T TAKE A CHANCE!

VACUUM CLEAN HAZARDOUS LOCATIONS IN COMPLETE SAFETY... FOR ADDED SAFETY

Use a Doyle

EXPLOSION PROOF VACUUM

"The motor, switch, tank, hose, every part of the Doyle EXPLOSION PROOF Vacuum Cleaner is U. L. approved for safe operation in the presence of . . .

1. Atmospheres containing gasoline, hexane, naphtha, benzine, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, or natural gas.
2. Atmospheres containing starch, flour, or grain dust.

U. L. APPROVED* FOR HAZARDOUS LOCATIONS } **Class 1, Group D**
Class 2, Group G

Don't take unnecessary chances . . . improve your safety record by maintaining "good housekeeping" in critical areas with a Doyle Explosion Proof Vacuum Cleaner.

As part of your regular cleaning schedule, this portable, lightweight vacuum is safe for recovery of liquids or dry materials in atmospheres containing highly explosive or inflammable dust and gases. The entire unit is static conductive and has been tested and approved by Underwriters' Laboratories as explosion proof.

Use the Doyle Explosion Proof Vacuum Cleaner as you would an ordinary heavy duty industrial vacuum. The big difference is, now you can clean floors, walls, bins, beams, pipes or ceiling in hazardous areas. In many cases daily use of this rugged machine does a rapid and efficient job of guarding against an explosion or fire.

Keep your safety up by using a Doyle Explosion Proof Vacuum Cleaner. Every advantage of more than 25 years experience in manufacturing industrial vacuum cleaners is incorporated in this unit.

Write today for detailed information and specifications.

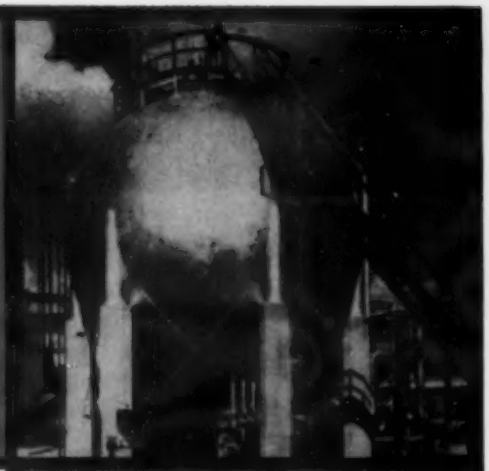
Doyle

Specialists in Industrial Vacuum Cleaning Equipment

VACUUM CLEANER COMPANY

243 Stevens Street, S.W. **Grand Rapids 2, Michigan**

WHY IS PETRECO-DESALTED CRUDE A SAFER REFINERY CHARGE THAN A NON-DESALTED "LOW-SALT" CRUDE?



Even "low-salt" crude causes trouble. The trend in desalting performance is increasingly toward maximum removal, minimum residual salt.

Petreco desalting provides removal percentages in the 98 to 100% range, with residual salt averaging 1.5 ptb. and less.

A "low-salt" crude often contains solids such as sand, silt, rust and other plugging or abrasive materials to such a degree that they are more troublesome than salt.*

Petreco desalting effectively removes such solids and fines.

A refinery operation planned on a "low-salt" charge is greatly upset if it becomes necessary to charge a salty crude.

Petreco desalting insures smooth operations regardless of the salt and solids content of the crude charge. Petreco desalting has effectively desalted every crude charged to it.

Minute quantities of arsenic can be present in any crude, "low-salt" or otherwise, and severely impair catalysts.

Petreco desalting reduces arsenic, stops catalyst poisoning.

Regardless of salt content, "slugs" of water are sometimes picked up in the crude charge when tanks are switched. Such water-slugs play havoc with distillation equipment.

Petreco desalting eliminates the hazard of water "slugs."

The storage of crude oils in the refinery often results in the deposition of "tank bottoms." These bottoms displace storage capacity, and cause an expensive disposal problem.

With Petreco desalting in the refinery, tank bottoms can be metered into the crude charge and easily disposed of.

*In one refinery, usually charging crude containing only 5 ptb, Petreco desalting showed a rapid pay out solely on the basis of solids removed.

6 REASONS WHY PETRECO DESALTING IS PREFERRED BY SO MANY LEADING REFINERS

1 Highest salt removal efficiency

2 Only all electric desalting process

3 Desalts all types of crude

4 All basic equipment is designed by Petreco and furnished by Petreco

5 Petreco guarantees results and treating costs

6 Petreco desalting service staff offers know-how and facilities unexcelled in the desalting field

Be sure you get all the facts on the Petreco Electric Distillate Treating Process:

ELECTROFINING

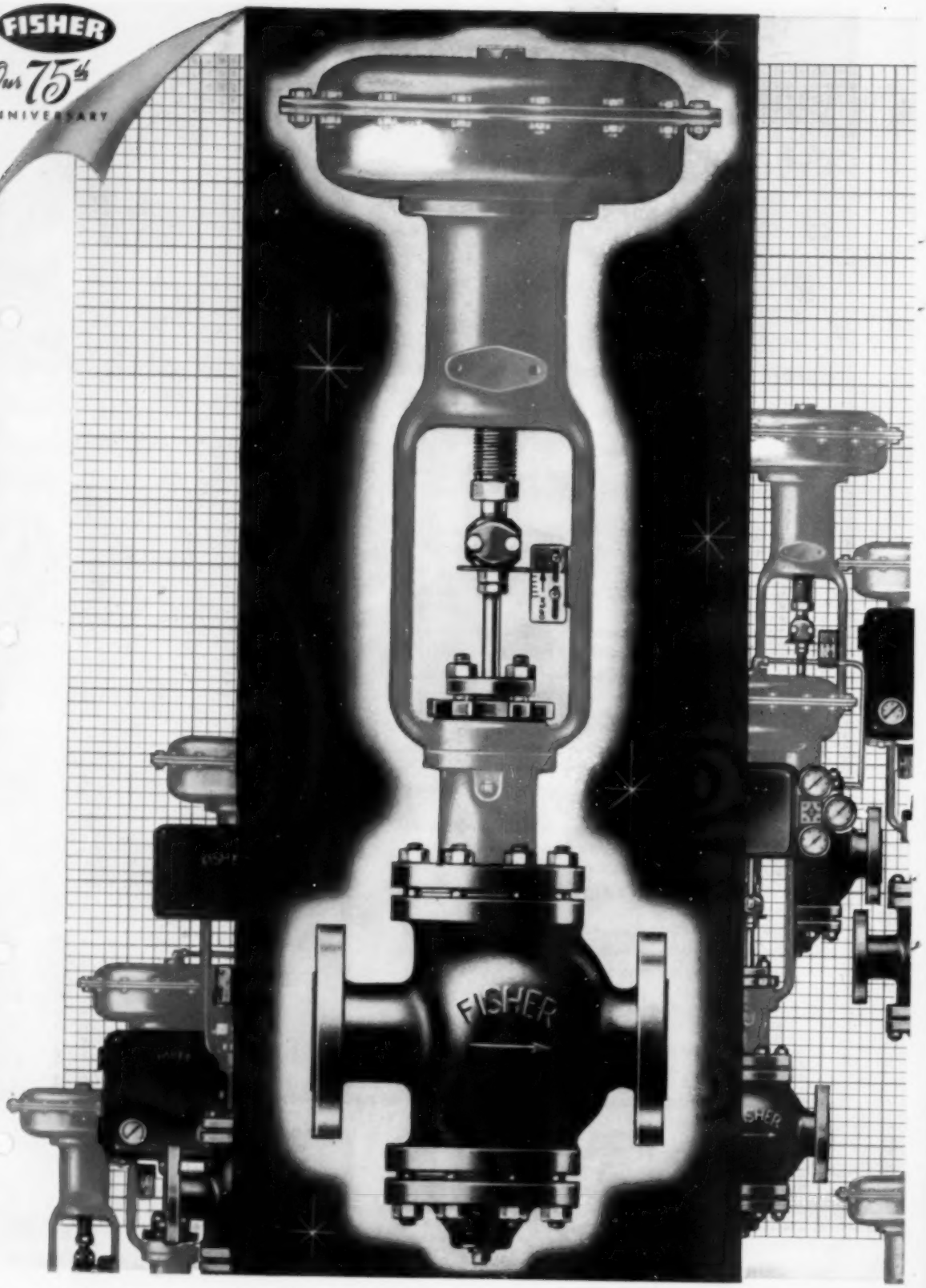
PETRECO

A DIVISION OF PETROLITE CORPORATION

3202 SOUTH WAYSIDE DRIVE, HOUSTON 1, TEXAS • 1390 EAST BURNETT STREET, LONG BEACH 6, CALIFORNIA

DS-9

FISHER
Our 75th
ANNIVERSARY



FISHER®

Presents An Improved

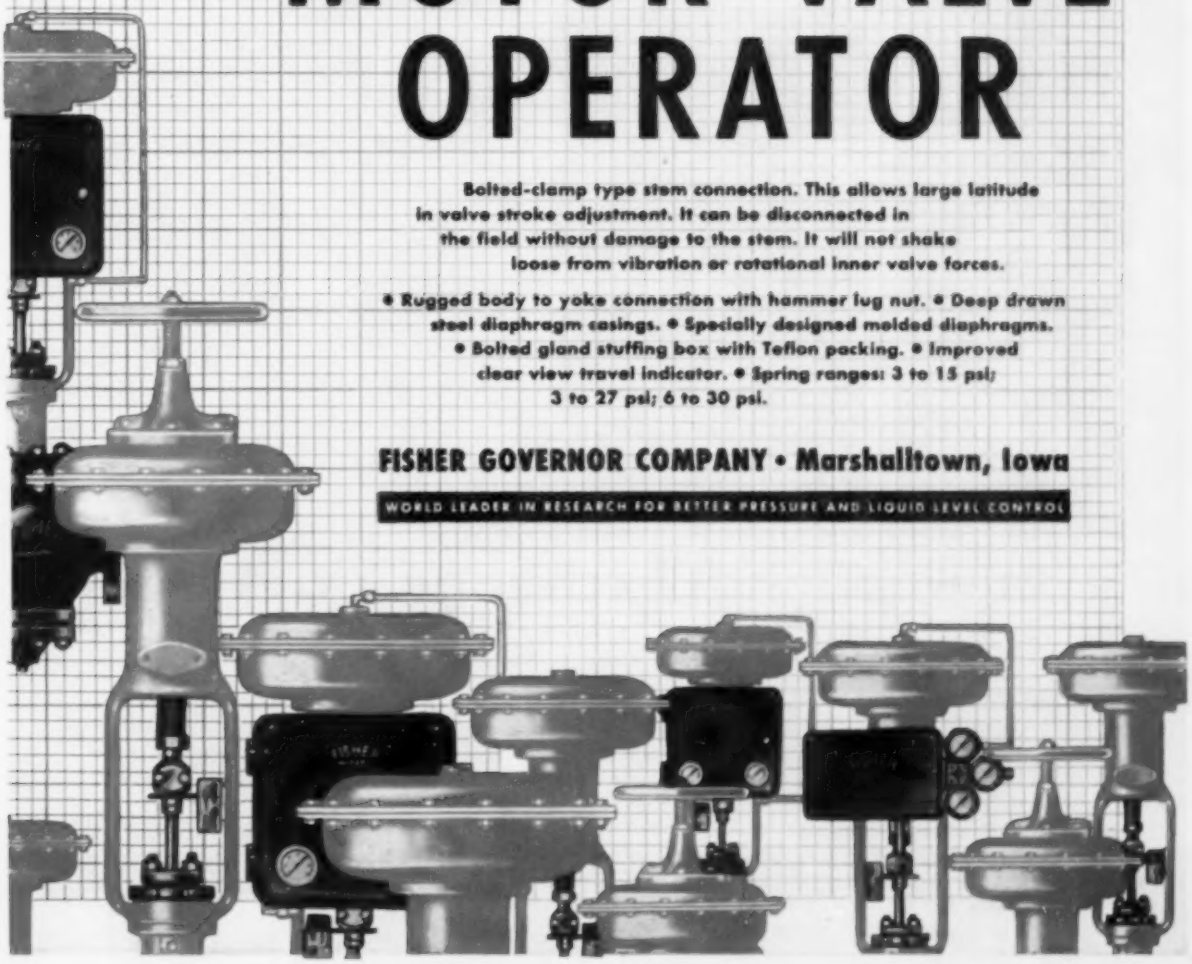
DIAPHRAGM MOTOR VALVE OPERATOR

Bolted-clamp type stem connection. This allows large latitude in valve stroke adjustment. It can be disconnected in the field without damage to the stem. It will not shake loose from vibration or rotational inner valve forces.

• Rugged body to yoke connection with hammer lug nut. • Deep drawn steel diaphragm casings. • Specially designed molded diaphragms. • Bolted gland stuffing box with Teflon packing. • Improved clear view travel indicator. • Spring ranges: 3 to 15 psi; 3 to 27 psi; 6 to 30 psi.

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

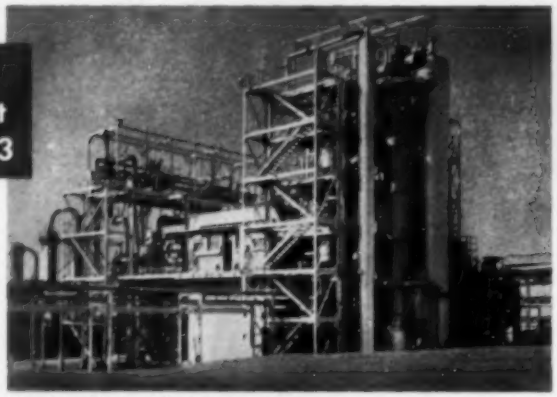
WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL



NEW DEVELOPMENTS

3rd Ethylene Oxide Plant To Use SD's Direct Oxidation Process

First Plant 1953



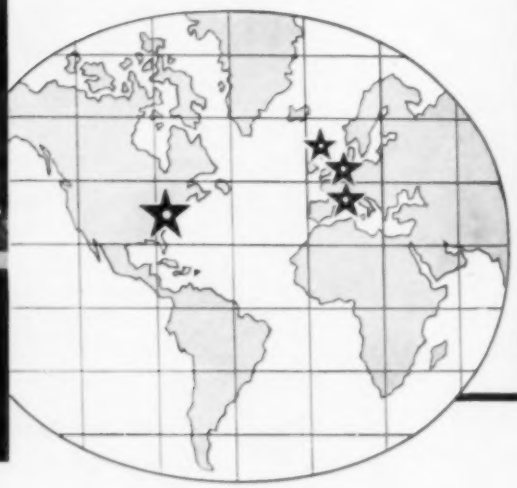
Naphtachimie Plant Lavera, France

Third Plant 1956

Societé Chimique des Derives du Petrole Antwerp, Belgium

"We knew from our labpratory work in America that ethylene oxide could be produced at a lower cost by our direct oxidation process. Our pilot plant work in England proved it," says Dr. Robert Egbert, SD's Vice President of Engineering.

Dr. Philip Newman, SD's European Representative, says, "Our transatlantic experience in adapting standards of various countries to SD's process resulted in greater flexibility of design, as well as continued improvement of the process."



SD's "International Exchange" Pays Off

So far the payoffs have been in Lavera, France, and the United States. Next year SD crosses the Atlantic again for Societé Chimique des Derives du Petrole's new ethylene oxide and ethylene glycol plants in Antwerp, Belgium.

The less expensive direct oxidation process used in these ethylene oxide plants was developed in SD's American headquarters laboratories and put in pilot plant operation in England.

Naturally, there were many problems in "translating" data—both from pilot plant to commercial production and from foreign engineering practices to American standards. SD's international experience in ethylene oxide also provided the background necessary to solve these problems of "translation" in chloromethanes, citric acid and maleic anhydride processes.

Today, American companies can take advantage of the continued "international improvement" of SD's lower cost process of direct oxidation of ethylene.

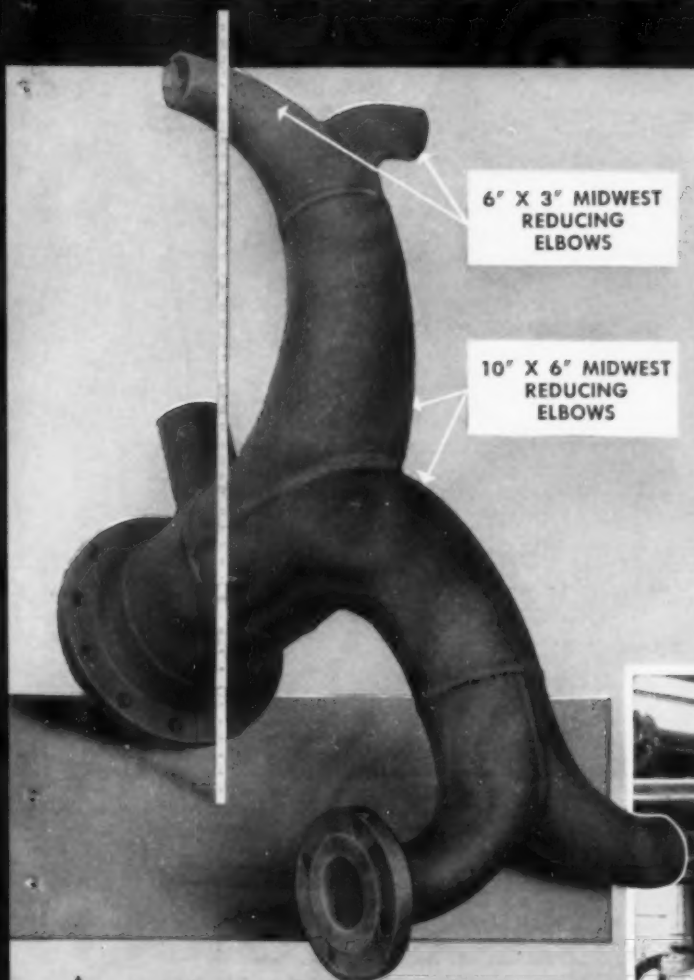
On this or any other organic chemical plant design problem, SD's services are available to you on a confidential basis. In new plant construction or the revamping of existing facilities to increase production efficiencies, you will profit by utilizing SD's specialized experience in organic chemicals plant design.

SCIENTIFIC DESIGN COMPANY, INC.

Executive Offices:
Two Park Avenue
New York 16, N. Y.
Engineering Offices:
Jersey City, New Jersey

Better Piping at a Better Price

by Using MIDWEST REDUCING ELBOWS

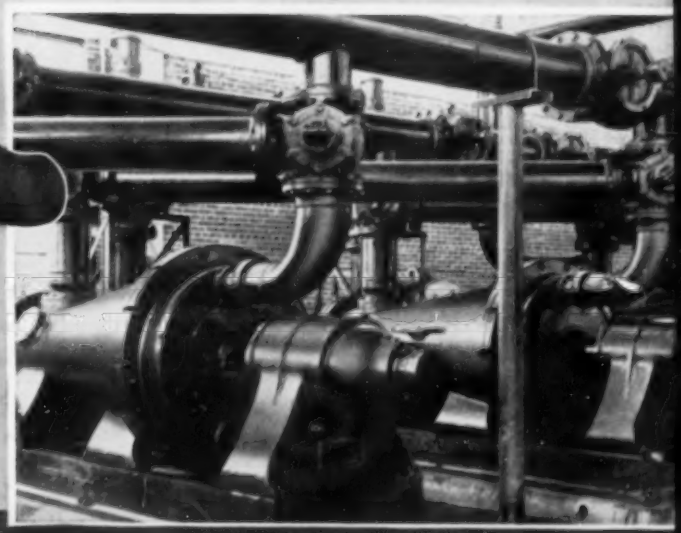


Midwest Reducing Elbows made it possible to fabricate this transformation piece for a boiler feed suction line so that it could be installed in the limited space available and still get the benefit of streamline flow. There was also a cost saving in comparison with a less efficient and bulky assembly made with straight tees, ells and reducers.

The Midwest Reducing Elbow offers important advantages in both piping design and piping cost. It needs only two welds instead of the three required by a standard elbow and a reducer (see sketch above). There is also a saving in layout time. Turbulence and pressure drop are reduced by the gradual taper . . . less space is needed . . . insulation is easier . . . and piping appearance is improved.

Only Midwest Reducing Elbows are available from stock in sizes to 16" . . . larger on special order. They have the same dimensional accuracy, uniformity of wall thickness, exact included angle and true center-to-end dimensions of Midwest Straight Elbows. For further information, ask for Catalog 54.

6999



Paper stock flows with minimum resistance through Midwest Reducing Elbows from 8" connection on Jordan to 10" header. Other advantages over standard elbow and reducer: a saving in cost and space, and improved appearance.

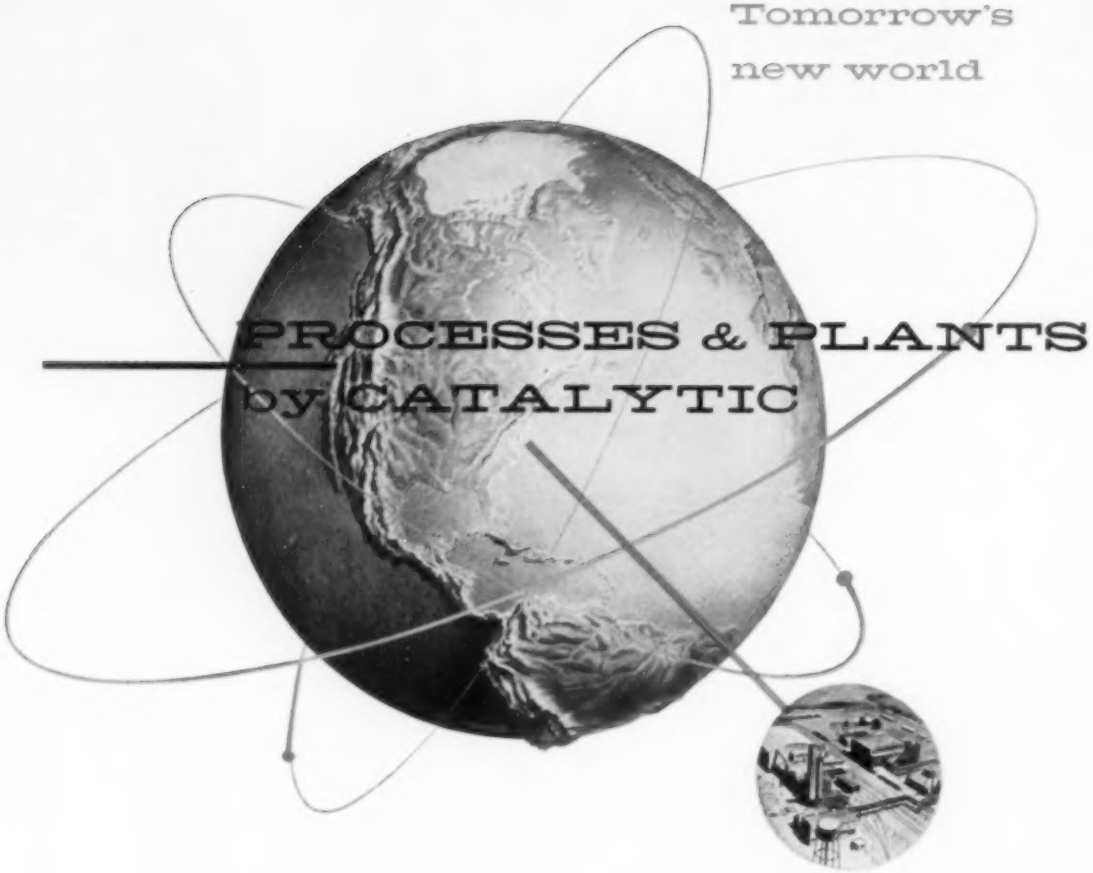
MIDWEST WELDING FITTINGS
Improve Piping Designs
and Reduce Costs

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Toward
Tomorrow's
new world



PROCESSES & PLANTS
by CATALYTIC

YOUR ENGINEERING PROBLEMS OF TODAY in chemicals, petrochemicals, metallurgy, atomic energy and petroleum...are met with CATALYTIC'S broad and diversified experience, imagination and skill—to give you better and more profitable products for tomorrow's new world.

CATALYTIC
CONSTRUCTION COMPANY
1528 Walnut Street
Philadelphia 2, Penna.

IN CANADA:
Catalytic Construction of Canada, Limited
Sarnia, Ontario

CATALYTIC *ON-TIME...ON-BUDGET* SERVICES for the metallurgical, chemical, petrochemical and oil refining industries
Project Analysis Process Development Process Design Economic Studies Engineering Procurement Construction Plant Operation

PERFORMANCE AND PRICE...

make Benson Aluminum Drums Ideal for Norda Essential Oil & Chemical Company, Inc.

PROBLEM:

Shipment of aromatic and essential oils for cosmetics and food stuffs by Norda Essential Oil & Chemical Co., New York.
(Galvanized and steel drums cause contamination of oil products. Glass containers too fragile—stainless steel too expensive.)

SOLUTION:

Purchase of 600 Benson Aluminum Drums
(Strong, light, corrosion resistant aluminum drums prevent contamination, are highly durable, provide easier handling and storage.)

Light weight of aluminum drums facilitates handling and shipping.

Aluminum drums protect against contamination and shipping damage.

Durable aluminum drums have a long, useful life—despite hard usage.

First cost alone is only the beginning of the savings advantages of Benson Aluminum Drums. Replacements are less frequent—aluminum drums won't rust or shatter. Light weight saves on handling and shipping charges. There are no costs for application of protective coatings . . . no losses through contamination of chemical contents. For further information contact the Reynolds office listed under "Aluminum" in your classified directory or write *Reynolds Metals Company, P.O. Box 1800-CS, Louisville 1, Ky.*

REYNOLDS ALUMINUM

EXCLUSIVE SALES AGENTS FOR BENSON CHEMICAL DRUMS

(To obtain more data on advertised products see page 1472)

JZ
JOHN ZINK

Regardless of the type of Gas to be burned a John Zink Burner will do it!

The newest burner in a long line of firsts is the Series VPM designed to burn gas of *high* hydrogen content. The series VPM is an adaptation of the popular BI-MIX burner. One customer reports
—"very satisfactory
—flame short and crisp with primary air door open
—can be adjusted for luminous flame when desired
—fuel of coke oven gas at 55.4% hydrogen has *no* flash back."

Only John Zink makes the always improving Vertical and Horizontal BI-MIX Burners!

The latest John Zink Burners are the:
Series ZSP—Sealed Port type.
Series VPM—Burns hydrogen.
Series PMS—Pre-mix for radiant furnaces.
Series CP—Package Boiler burner.
Series RCP—Package Boiler burner.
Field Flare Burners and Assemblies.

All John Zink Burners are protected by U.S. Letters of Patent.

JOHN ZINK COMPANY

4401 South Peoria Tulsa, Oklahoma

Here is the table of contents of one of the most valuable FREE books being offered to chemical and petroleum engineers today

PART 1

PROCESS INDUSTRIES APPLICATIONS

Typical Applications
Organic Chemicals
Inorganic Chemicals
Petroleum and Petrochemical
Food, Drug, Beverage
Plant Atmospheres
Advantages of ALCOA Aluminum
ALCOA Alloys Available
ALCOA Products Available
Research and Development

PART 2

PERFORMANCE OF ALUMINUM WITH CHEMICALS

A service dictionary listing over 450 products successfully handled by ALCOA Aluminum

PART 3

DESIGN OF PROCESS EQUIPMENT

Mechanical Considerations
Process Piping
Corrosion Considerations
Clad Aluminum Products
Cleaning Aluminum Equipment
Inhibitors
Coating Aluminum
Cathodic Protection of Aluminum
Aluminum Anodes for Cathodic Protection
Technical Reference Tables

This newest ALCOA book brings you right up to date on all of the latest developments in ALCOA Aluminum for the process industries. Generously illustrated with 95 photographs and flow charts, this 8½ x 11 inch book contains 80 fact-filled pages.

ALCOA has worked with the process industries for more than 40 years, gaining unsurpassed knowledge through practical experience and competent research.

This new book puts at your finger tips the benefit of ALCOA's vast experience with aluminum in hundreds of applications in the chemical and petroleum industries.

ALCOA Aluminum offers these outstanding advantages:

High resistance to corrosion
Freedom from product discoloration
Strength in alloys
Light weight
High electrical conductivity
Ease of fabrication
Nontoxic properties
Low maintenance costs

You'll want a copy of this valuable book for day-to-day reference on the many uses of economical ALCOA Aluminum. Write today.

Here's how to get your FREE copy. Write on your company letterhead for *Process Industries Applications of Alcoa Aluminum.*

ALUMINUM COMPANY OF AMERICA, 1000-J Alcoa Building, Mellon Square, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

FOR EFFICIENT CONTROL OF RISING INDUSTRIAL TEMPERATURES

KAYLO—*King of high temperature insulations*

FIBERGLAS—*World's leading industrial insulation*

Together they answer all your insulation needs!

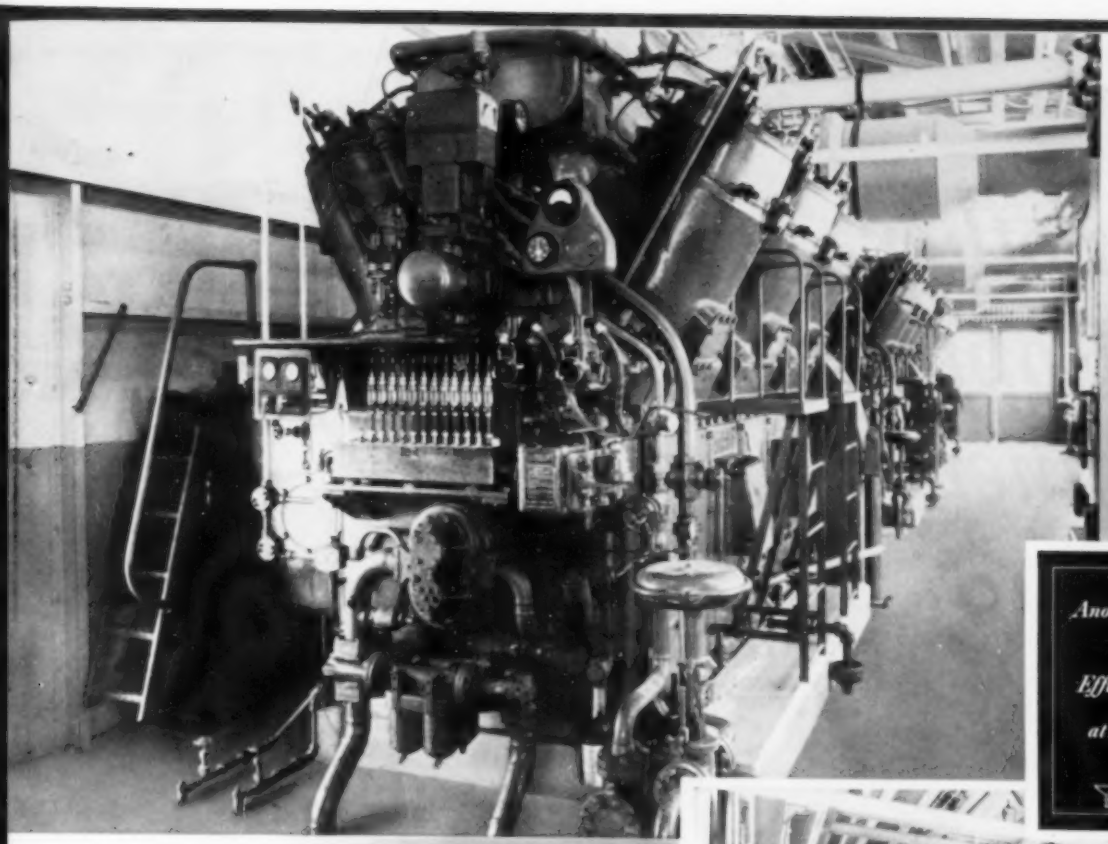
Average temperatures of industrial processes have increased to 500-700° F. from 350-500° in the past several years. Indications are that they'll go even higher in the future.

With Fiberglas® and Kaylo® Insulations, present and future temperatures can be efficiently controlled without adding undue bulk or cost. Both products have exceptionally low "k" factors. They're strong . . . moisture-resistant . . . stable . . . easy to apply . . . cover the entire range from lowest sub-zero to 1200° F.

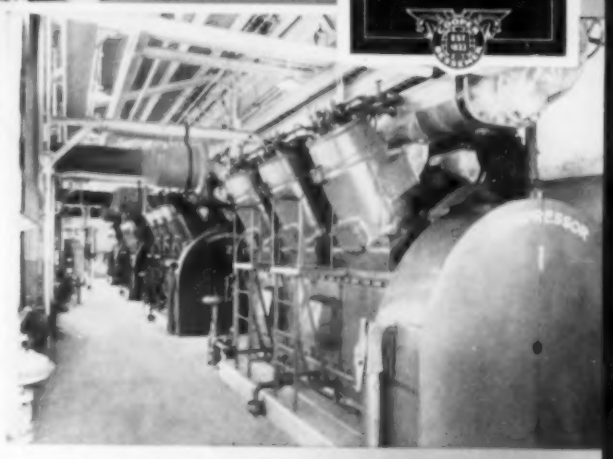
Kaylo is now distributed by Owens-Corning Fiberglas Corporation, and is available in quantity. For full technical data on Fiberglas and Kaylo, see Sweet's File, Chemical Engineering Catalog, or Refinery Catalog. Or write: Owens-Corning Fiberglas Corporation, Dept. 185-I, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS

®T. M. Reg. Owens-Corning Fiberglas Corporation
® Kaylo is mfd. by Owens-Illinois Glass Co., Inc.



Another Example of Efficient Power at Lower Cost



Shown here are Cooper-Bessemer compressors, located at Sun Oil Company's Marcus Hook petrochemical plant. Used to handle recycle hydrogen, these four GMV's are each rated 660 hp at 300 rpm.

In hydrogen service for petrochemicals

COOPER-BESSEMER GMV's...

Where EXTREME Reliability is a MUST!

• In Sun Oil's $15,000,000 petrochemical plant at Marcus Hook, Pa., three 6-cylinder Cooper-Bessemer GMV compressors efficiently handle the recycling of hydrogen, while a fourth unit is in stand-by service. Three more similar units are being added for current plant expansion.

Employing both the Houdriforming and Udex processes, the Marcus Hook installation is designed to produce benzene, toluene and mixed xylenes, or high octane motor fuel. In the Houdriforming process, it is extremely important to maintain a continuous hydrogen supply.

Handling this vital recycle hydrogen, are 660 hp Cooper-Bessemer compressors . . . long recognized for the very best in *reliable service* and economical operation.

Like Sun Oil, you too will be performance ahead with highly efficient, trouble-free Cooper-Bessemers. So, if future plans call for compressor horsepower offering tops in dependability and flexibility, get complete facts on the latest V-angle developments.

MOUNT VERNON, OHIO

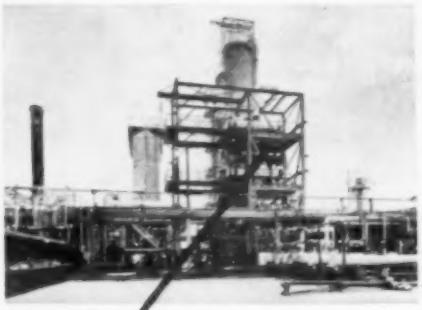
COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

Another Complete Refinery



CRUDE UNIT: capacity 10,000 barrels per calendar day.

DELAYED COKING UNIT: 2,500 barrels a day reduced crude; produces approximately 74 tons a day of coke.

CATALYTIC CRACKING UNIT: capacity 7,000 barrels a day of total feed.

CATALYTIC POLYMERIZATION UNIT: capacity 1,700 barrels a day of mixed $C_3 - C_4$ stream.

CATALYTIC REFORMING: 3,500 barrels a day of heavy naphtha.

FOSTER

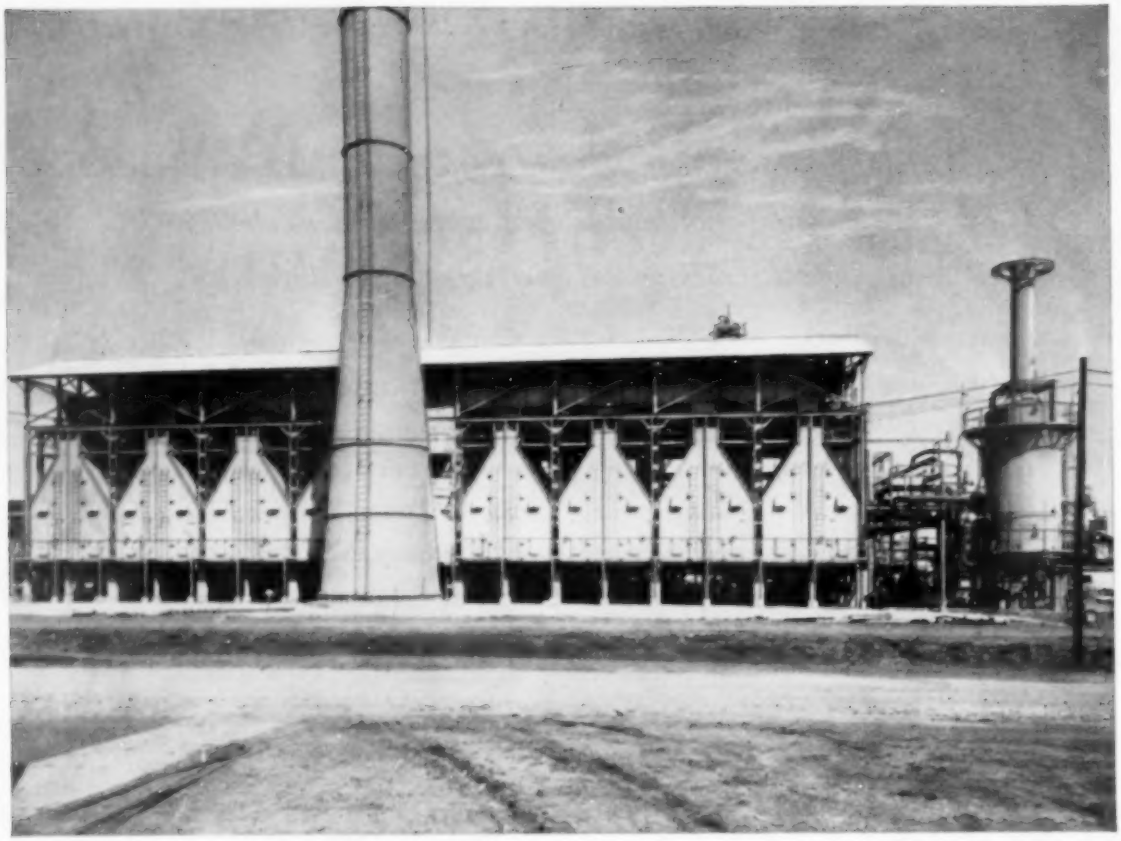
NEW YORK • LONDON

Built for The Texas Company at El Paso, Texas, this new integrated refinery consists of crude and delayed coking units, as well as units for catalytic cracking, polymerization and reforming.

To companies the world over that now are contemplating new refinery expansion, Foster Wheeler offers the significant advantages of its worldwide experience in the design, engineering and construction of completely integrated refining facilities. For proposals to meet your specific requirements, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

WHEELER

PARIS • ST. CATHARINES, ONT



200 million pounds of Ethylene can be produced yearly by this bank of eight ethane cracking furnaces at the Tuscola, Illinois plant of National Petro-Chemicals Corporation, (a joint enterprise of National Distillers Products Corporation and Panhandle Eastern Pipeline Company). Largest single installation of its kind to date, these furnaces, operating above 1500F°., produce ethylene by cracking ethane in Incoloy tubes.

Incoloy tubes perform successfully in hydrocarbon cracking furnaces

The Incoloy* tubes in the ethane cracking furnaces shown above have now given two years satisfactory service — with promise of more to come. Operating temperatures are in excess of 1500°F. A number of installations in other plants have given as much as four years' service in cracking ethane and propane for production of ethylene.

The reasons? Incoloy has high creep and rupture strengths at elevated temperatures. It resists carburization and is stably austenitic. After prolonged exposure to intermediate temperatures, Incoloy shows only slight tendency to become embrittled by carburization and none at all due to structural changes.

You can use Incoloy at temperatures right up to 1800°F. And it gives an improved safety factor in decoking where temporary hot spots may occur.

Incoloy offers economy

In addition to improved performance features, Incoloy also offers a decided price advantage, compared with certain alloys, when it is used as extruded tubing.

Comparatively low thermal expansion and good weldability are other characteristics that make Incoloy an attractive material for this application.

If the severe conditions involved in hydrocarbon cracking or in natural gas reforming are a problem to you, why not consult our High Temperature Engineering Section? They will be glad to help you without cost or obligation.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

*Registered trademark of The International Nickel Company, Inc., applied to a nickel-chromium-iron alloy produced and marketed by it.

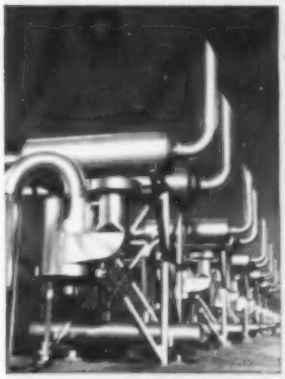
INCO TRADE MARK **Incoloy**

Here's how America's oil industry uses aluminum paint

For tanks. Sinclair Refining Company has used aluminum paint since 1916 for coating bulk stations, terminals, tank farms and refinery equipment like this installation at Marcus Hook, Pa. Because Sinclair Aluminum Paint is outstanding in the protection of metal, reducing evaporation losses and improving appearance it is the standard protective coating for Sinclair's refineries throughout the country. *Aluminum Paint: Sinclair Refining Co., Paint Department, New York.*

For rigs, oil field equipment. The Parkersburg Rig and Reel Company, Parkersburg, W. Va., has painted its rigs, lease tanks and other equipment with aluminum paint since 1925. This company finds that aluminum paint provides better protection against rust, lasts longer, makes a more attractive appearance, is easier touched up without looking "patched up."

For towers. Magnolia Petroleum Corporation paints towers like these at the Chitwood Gasoline Plant with aluminum. Magnolia finds that aluminum paint improves appearance, is easy to apply and has excellent qualities of durability. *Aluminum paint: Socony Paint Products, Inc., New York.*



For mufflers. These 400°-600° F mufflers at Cotton Valley Operators Committee, Recycling Plant, Cotton Valley, Louisiana, were constantly rusting and peeling, requiring frequent repainting. High-heat aluminum paint was tried, and is now the standard heat-resistant finish for this plant. *Aluminum paint: Silicone Aluminum, Kansas Paint & Color Company, Wichita, Kansas.*

For heater stacks. Warren Petroleum Corporation reports that aluminum paint has an effective service life of 18 months or more on oil heater stacks where surface temperatures range from 400°-600° continuously. Previously used paints had lasted only a few days. Now, high-heat aluminum paint by Kansas Paint & Color Co. is a standard at all Warren plants.

Leading refineries rely on aluminum paint for maximum protection, long service life, unsurpassed economy. Examples such as these demonstrate why aluminum paint has become the most popular, most practical paint in the petroleum industry. **ALCOA does not make paint,** but ALCOA Aluminum Pigments are used in more aluminum paints than any other brand. Special formulas have been developed by your paint manufacturer to solve individual problems. Paints made to these formulas actually cost less, last longer, give utmost protection against heat, cold, sun, rain, smoke, fumes.

Write today for our FREE booklets, *Painting With Aluminum* and *Aluminum Asphalt Roof Coatings Make Time Stand Still.* They contain valuable, up-to-date information on all types of aluminum paint and aluminum roof coatings. Use the coupon.

PIGMENTED WITH
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, Paint Service Bureau
1792-J Alcoa Building, Pittsburgh 19, Pennsylvania

Please send me your FREE booklets:

- ☐ Painting With Aluminum
- ☐ Aluminum Asphalt Roof Coatings Make Time Stand Still

Name_____

Company_____

Address_____

City_____ Zone____ State_____

SUN'S NEW CAT CRACKERS WILL DELIVER BTU TO B&W-OXY-Catalyst Boilers

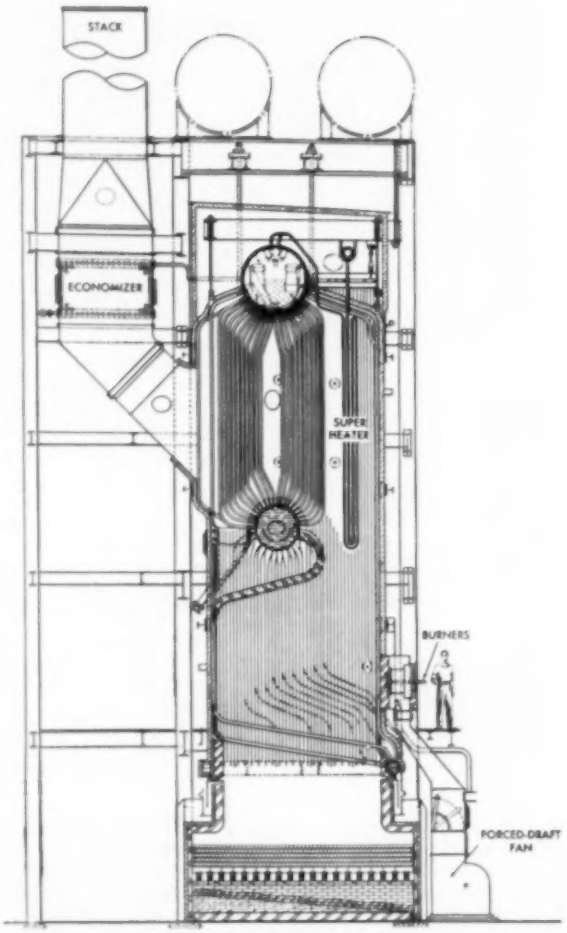
Sun Oil has undertaken an important program of efficiently utilizing the millions of Btu generated in the operation of its catalytic cracking units. Through the use of a new platinum oxidation catalyst, manufactured by Oxy-Catalyst, Inc., the combustibles in the gas streams leaving Sun's new Houdriflow units will be completely burned and the heat absorbed by B&W-Oxy-Catalyst Boilers; thus Sun Oil will save thousands of dollars annually.

Two years ago Sun installed Oxy-Catalyst elements in the exhaust gas stream of one of their fixed bed Houdry units, and proved the feasibility of using the platinum catalyst to burn the combustibles in the cracking unit exhaust gas stream.

This development work resulted in the installation of a Babcock & Wilcox Boiler in Sun's Toledo Refinery especially designed for operation with an Oxy-Catalyst bed. The B&W-Oxy-Catalyst Boiler absorbs the heat from a new Houdriflow cracking unit exhaust gas stream after the combustibles in this stream have been completely burned in the Oxy-Catalyst bed. This unit went on stream in May 1955. A duplicate unit has been completed at Sun's Marcus Hook, Pennsylvania, Refinery, and started operation June 1955.

The Sun Oil Company is spending large sums in its efforts to prevent air contamination and to recover valuable heat otherwise lost to the atmosphere in the air used for catalyst regeneration. The Babcock & Wilcox Company is happy to work with the Sun Oil Company and Oxy-Catalyst, Inc., in this new development which not only accomplishes important fuel savings but also establishes control over the discharge of contaminants to the atmosphere.

The boilers just described are the first of their kind to be installed. Sun Oil also placed one of the first B&W "CO" boilers in operation early in 1954. These boilers burn the combustibles in cracking unit exhaust gas streams by burning supplementary fuel to maintain the proper temperature for combustion in their furnaces. The Babcock & Wilcox Company, therefore, is prepared to quote on and build all types of cracking unit exhaust gas boilers, conventional waste heat, Oxy-Catalyst Boiler or CO Boiler, whichever is necessary to meet your steam and process requirements.



SECTIONAL VIEW OF THE CO BOILERS AT TOLEDO AND MARCUS HOOK

BABCOCK & WILCOX
BOILER DIVISION

G-720

Every week Harshaw produces carloads of catalysts, and every week we produce orders of only a few pounds for customers' experimental purposes. Whether your catalyst requirement is measured in tons or pounds, we have modern facilities for giving you exactly the catalyst you want. If you are in the experimental or development stage and need only a few pounds of your catalyst, call for our technical assistance; if you are in the production stage, call on Harshaw to produce any amount of catalyst you need. Our ability to produce will provide the catalyst... when you want it. If your mind's on catalysts, call Harshaw today.

HARSHAW produces carloads of catalysts *every week*

HARSHAW

Write for our free booklet, "Harshaw Catalysts"

HARSHAW CATALYSTS AVAILABLE IN 7 FORMS

- Tablets
- Extrusions
- Powders
- Spheres
- Granules
- Rings
- Flakes

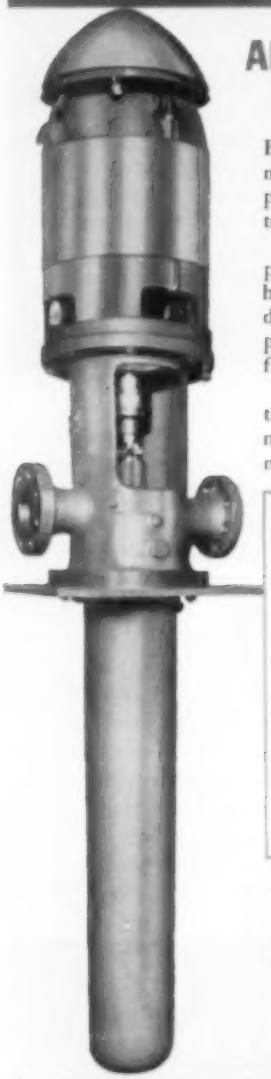
THE HARSHAW CHEMICAL CO.

1945 East 97th Street, Cleveland 6, Ohio

Chicago 32, Ill. · Detroit 28, Mich. · New York 17, N. Y.
Cincinnati 13, Ohio · Houston 11, Texas · Philadelphia 48, Pa
Cleveland 6, Ohio · Los Angeles 22, Calif. · Pittsburgh 22, Pa.

 (To obtain more data on advertised products see page 1472)

NEW! Bingham VCP VERTICAL PUMP FOR LOW NPSH



ALL WORKING PARTS ACCESSIBLE WITH BOTTOM DISMANTLING

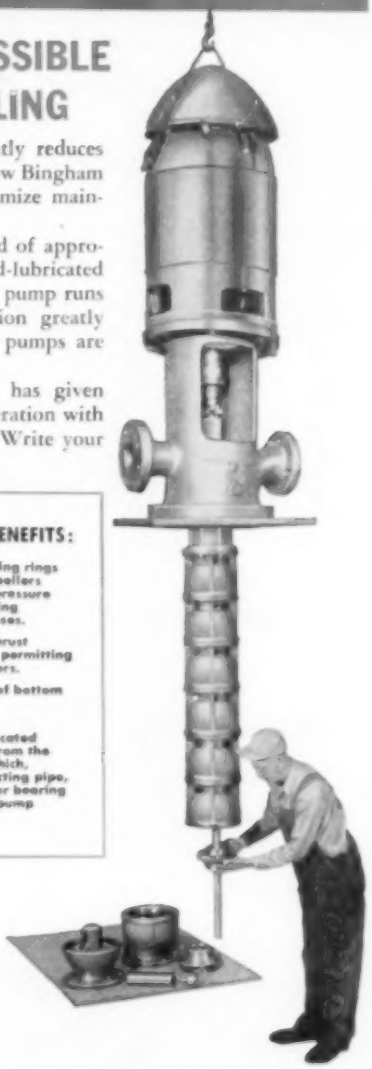
Besides bottom dismantling, which in itself greatly reduces maintenance time when attention is required, this new Bingham pump incorporates advanced features which minimize maintenance, reducing need for periodic inspection.

For example, all intermediate bearings (supplied of appropriate material for different pumpages) are forced-lubricated by pumpage. Bottom bearing is lubricated, even if pump runs dry for short periods. This *dependable* lubrication greatly prolongs life of bearings, which in conventional pumps are frequently the cause of maintenance shutdowns.

Wherever installed, the Bingham VCP Pump has given trouble-free service—plus unsurpassed smooth operation with no vibration. Available for any capacity or head. Write your nearest Bingham office for additional information.

ONLY Bingham OFFERS ALL THESE BENEFITS:

1. Heavy-duty steel suction and discharge head rigidly built to eliminate vibration caused by drivers.
2. Shaft is maximum diameter throughout.
3. Shafts are equipped with renewable 11-13 chrome, hardened, ground and polished sleeves at each bearing.
4. Bearings are of the appropriate material for the different pumpages.
5. Maximum head per stage and maximum efficiency for a given capacity range.
6. Front and back wearing rings on enclosed type impellers permit a one-stage pressure drop over each bearing for lubrication purposes.
7. Wear rings reduce thrust of rotating element, permitting use of standard motors.
8. Maximum eye area of bottom impeller for lowest possible NPSH.
9. Bottom bearing lubricated by pumpage taken from the discharge column, which, together with connecting pipe, acts as a reservoir for bearing lubrication in event pump operates "dry" for short periods.



All working parts of pump easily accessible with bottom dismantling. One man can service after lifting pump from well. By dismantling from bottom, repair or replacement of any part can be made in much less time than with conventional pumps (where dismantling begins from top, necessitating removal of driver and head before pump unit is accessible).

Various operators estimate that time required to reach working parts has been reduced as much as 50%.

Bingham SINCE 1921

DOUBLE VOLUTE RADIAL BALANCE PUMPS

BINGHAM PUMP COMPANY

General Offices: 2800 N.W. Front Avenue, Portland 10, Oregon

Factories: Portland, Ore. • Vancouver, B.C., Canada

SALES AND SERVICE OFFICES

BOSTON, MASS.
CHICAGO, ILL.
DENVER, COLO.
HOUSTON, TEXAS
KANSAS CITY, MO.
NEW ORLEANS, LA.
NEW YORK CITY, N.Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CALIF.
SEATTLE, WASH.
ST. LOUIS, MO.
ST. PAUL, MINN.
TULSA, OKLA.
TORONTO, ONT., CAN.
VANCOUVER, B.C., CAN.

WATSON-STILLMAN FORGED STEEL FITTINGS FOR: *Safe, Tight Connections* in pressure piping

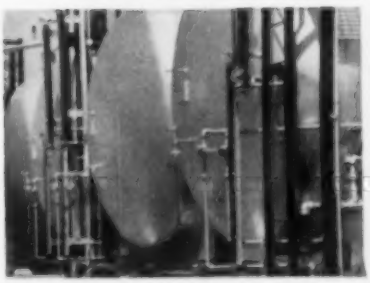
■ In high pressure steam lines... process liquid and gas piping... hydraulic fluid lines... wherever strong, tough pipe joints are needed. Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too... such as the heavy reinforcing bands extending well beyond the threads or sockets.

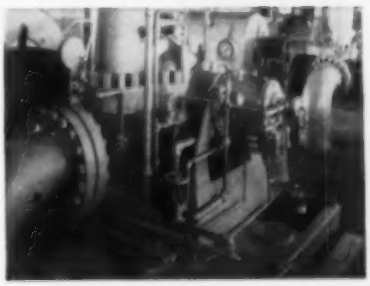
Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.

Bulletin A3-50—Forged Steel Fittings
Bulletin S-1-55—Stainless and Alloy Fittings
Bulletin U-1—Forged Steel Unions
Bulletin S-3-55—150 lb. Stainless Fittings

Sold Through Leading Distributors



• *Process Liquid and Gas Piping*

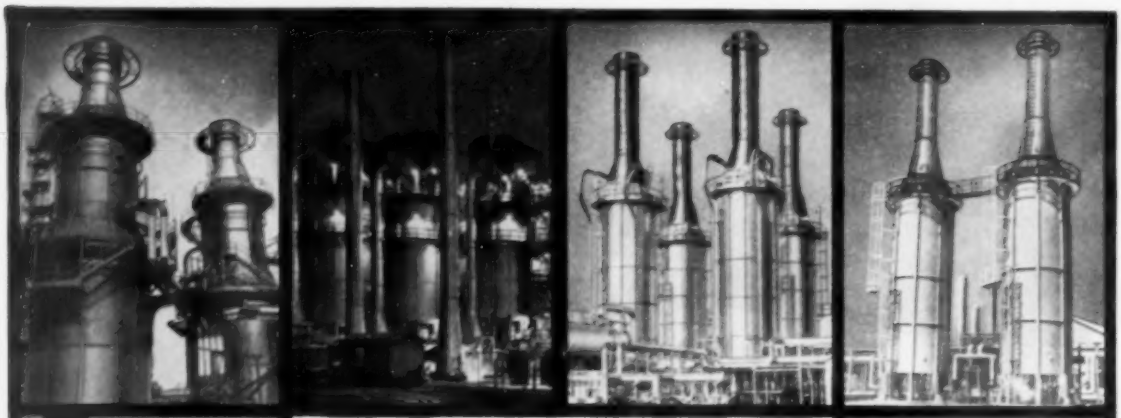


• *High Pressure Lines*

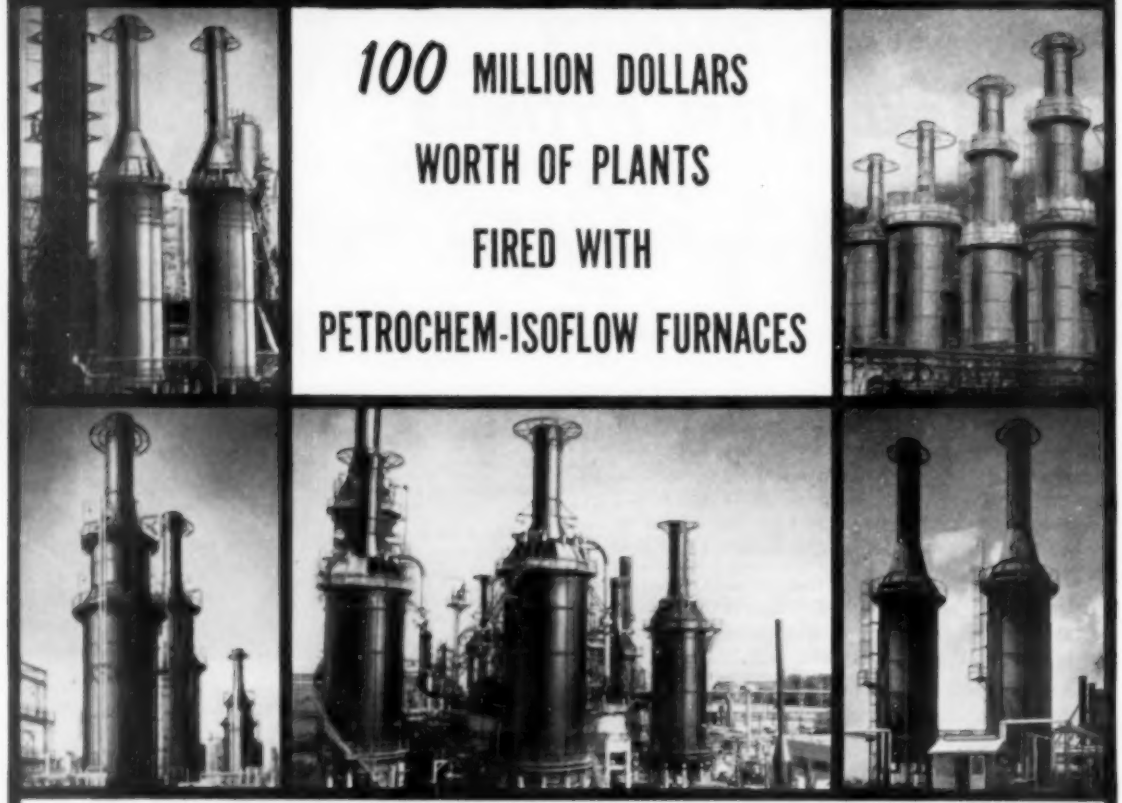
WATSON-STILLMAN FITTINGS DIVISION

H. K. Porter Company, Inc.
Roselle, N. J.

(To obtain more data on advertised products see page 1472)



100 MILLION DOLLARS WORTH OF PLANTS FIRED WITH PETROCHEM-ISOFLOW FURNACES



More than 1250 Petrochem-Isoflow Furnaces are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petrochem-Isoflow Furnaces are most efficient by any comparison.

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE ... CAPACITY ... DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholtz, Los Angeles • Gordon D. Hardin, Louisville • Turbex, Philadelphia

International Licensees and Representatives: SETEA—S.A. Comercial, Industrial, y de Estudios Tecnicos, Buenos Aires, Argentina • Promotora Nacional De Industrias, S.A., Caracas, Venezuela • Firme Dr. C. Otto & Comp. G.M.B.H., Bochum, Germany • Birwelco Ltd., Birmingham, England • Societe Anonyme Heurtey, Paris, France • Societe Anonyme Belge, Liege, Belgium • Heurtey Italiana S.P.A., Milan, Italy

Slashing Costs With Trufin
—Number 9 of a Series

SAVE 22%

on Initial Heat Exchanger Cost

—with WOLVERINE TRUFIN* Type S/T

A net saving of 22% in condenser tube costs has been realized by one of the nation's largest petrochemical companies. The secret? Wolverine Trufin Type S/T!

In deciding to modernize and to step up capacity of its butylene concentration unit, nothing was left to chance. Comparison tests were run on both finned and prime surface units and bids were requested. The units designed around Trufin Type S/T were 22% lower in initial costs than prime surface units of the same capacity.

Although less expensive and smaller in size, the Trufin units after side-by-side comparison tests for one year, matched in every way the performance of their larger prime surface counterparts.

You, too, can cash in on equally large savings in your plant through use of Wolverine Trufin Type S/T condenser tube. Trufin, with its integral fins extruded directly from the tube wall, has over twice the outside surface area of prime surface tube. As a result, less tube is required—which in turn means smaller shells, headers and baffles and less maintenance.

Trufin is mechanically interchangeable with prime surface tube. The tube wall at the plain end is heavier than the wall at the finned section, giving greater rigidity and maximum protection at the header.

Plan now to utilize Trufin's full abilities—increase heat duty—save space—and dollars! To get the facts—write for your copy of the Trufin Opportunity Book. It's packed with actual Trufin case histories and valuable design information. Wolverine Tube, 1441 Central Avenue, Detroit 9, Michigan.

*REG. U.S. PAT. OFF.

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES

EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N. Y.

Take a cue from CORROSION

Corrosion—the bugaboo of refinery and petrochemical plants—is the big reason Wolverine offers condenser tubes in such a wide variety of metals and alloys. In addition, concrete on-the-spot help is offered by Wolverine through the use of its expanded Field Engineering Service.

Here are typical questions asked FES recently:

Q Does Wolverine have a tube that can withstand simultaneous inside and outside attacks from two different types of corrosion?

A We certainly do. Wolverine Duplex Condenser Tube consists of inner and outer tubes of different metals mechanically bonded together. Combinations of copper, copper-base alloys, aluminum or steel can be used to withstand different types of corrosion on either side.

Q Heavy concentrations of ammonia are causing frequent failure of our condenser tubes. What can we do?

A Retube with Wolverine steel condenser tube. It is because of just such cases as this that Wolverine manufactures tubing in a wide range of alloys in copper, aluminum and electric-welded steel. Customers must have a choice because **no one alloy can meet all conditions.**

Trade U.S. Pat. Off.

Q How can we overcome erosion in our salt water installations?

A Wolverine condenser tubes of 90-10 Cupro-Nickel can help overcome this condition. In addition to the right alloy Wolverine also insists, through rigid quality control, that its tubing be uniform and free from scratches, pits and inclusions. Such defects can give erosion its initial entry and speed tube failure.

Q We want to reduce weight in our sour gasoline condensers. Could we use aluminum condenser tubes?

A You bet! Wolverine 3S alloy aluminum tube is made to order for such operations. In addition to lightness you will also get high heat conductivity and find it easy to fabricate.

Don't let corrosion steal your tubing dollars. Wolverine's Field Engineering Service is ready at all times to help solve your problems. Call on them—today. Write, too, for your copy of the Wolverine Condenser Tube Book.

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

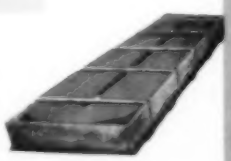
The WOLVERINE Line Up

1. WOLVERINE TRUFIN® TYPE S/T
The industry's only integral finned tube. (In copper, copper-base alloys, aluminum, electric-welded steel.)

2. PRIME SURFACE CONDENSER TUBE
In three metals and their alloys.

3. DUPLEX TYPE S/T CONDENSER TUBE
A liner of one metal, a finned exterior of another.

4. PRIME SURFACE DUPLEX CONDENSER TUBE
To combat two different corrosive attacks.



5. U-BEND CONDENSER TUBE
The only direct mill source . . . palletized!

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES

EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N. Y.

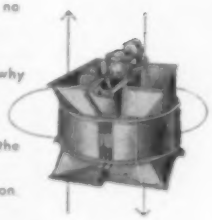
reduce slag

stay on stream at top capacity months longer with the Ljungstrom® Air Preheater

HOW FAST IS "WRITE OFF"?

By cutting turnaround time alone, the Ljungstrom means major savings for you. When you take the other Ljungstrom advantages into account—up to 20% fuel saving . . . more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . consistently higher through-put . . . higher product quality—you can see why a Ljungstrom is paid out in just a few months.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits attainable in fuel burning equipment—call or write The Air Preheater Corporation.



Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

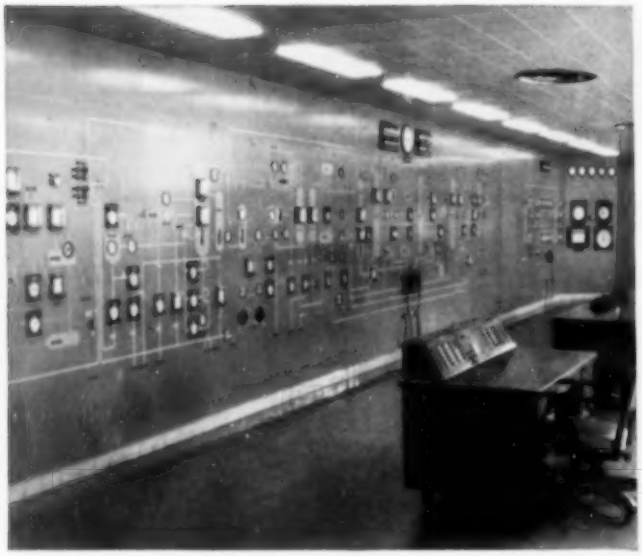
Slag—primary cause of reduced capacity—can be substantially reduced by the Ljungstrom Air Preheater.

That's because preheated air mixes more thoroughly with fuel. The result is better combustion . . . and less slag-forming material present in the furnace. Oil tubes stay cleaner . . . stills stay on stream at top capacity for months longer. As an example, one pipe still in an eastern refinery dropped from 16,000 barrels a day to 12,000 because of slag. Now, with a Ljungstrom and modern high-temperature burners, the still operates continuously at 18,000/20,000 barrels.

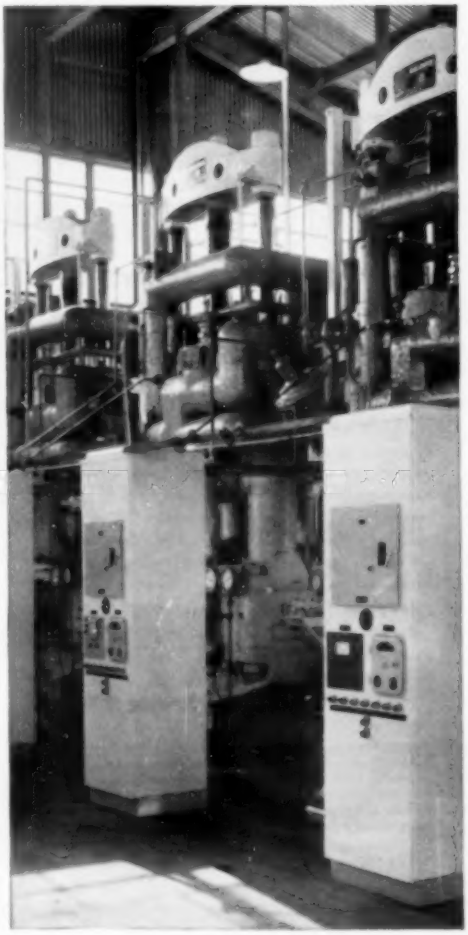
The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

INSTRUMENTATION IS AN OLD WESTERN CUSTOM

. . . that's why Taylor went to California 1895



Richfield Oil Corporation, Los Angeles. Taylor Transet Plug-in indicators, recorders and controllers on graphic panel for fluid catalytic cracking unit near Long Beach, receiving from Taylor flow, temperature and pressure transmitters.



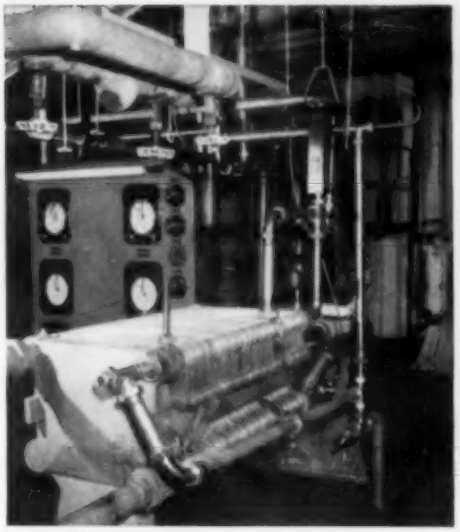
Brea Chemicals, Inc., Los Angeles. Typical of this company's wide use of Taylor instrumentation, the Flex-O-Timers (Time Cycle Controllers) shown here are the heart of automation for operating the dry ice presses at the Brea Chemicals, Inc. ammonia plant. They control the entire sequence of starting, filling, reverting, pressing, ejecting, and stopping.

THE five installations shown on these pages are typical of the instrumentation that is helping Western industries thrive.

Along with these 5 leaders, Taylor Instrument Companies welcome a visit from Instrument Society of America members attending the ISA Instrument-Automation Conference and Exhibit at Los Angeles. Taylor booths B436 - 437 - 438.

Taylor has maintained a plant in San Francisco for 18 years—and has had direct sales representation in the West for 60 years. We're happy to report that we are now in a better position to serve our customers than ever before, with the opening in June of a completely modern plant and sales office at San Leandro, Calif. The new plant is capable of duplicating many manufacturing and repair techniques followed at our main plant in Rochester, N. Y. Personnel-wise, the west coast office is second to none in years of diversified experience and engineering skill . . . our Field Engineers are seasoned veterans in the field of instrumentation. Their advice and help is yours for the asking.

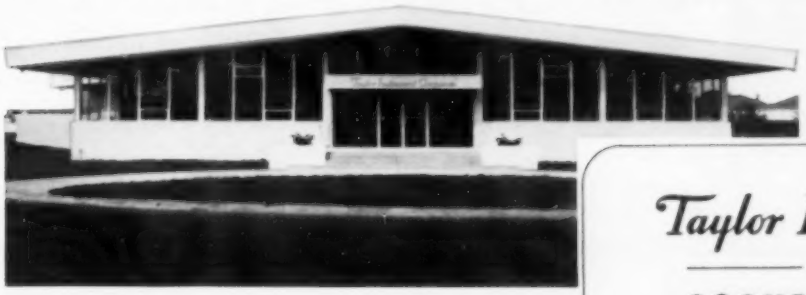
Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.



The Exchange Orange Products Co., Ontario, California. The Taylor controls on their plate-type juice heaters continuously regulate and record juice temperatures. Flow diversion valves automatically return any improperly pasteurized juice for reheating.

East Texas Pulp and Paper Co., Evadale, Texas. These Taylor Digester Control Panels, representative of their many uses of Taylor instrumentation, enable operators at this great new paper mill to produce some of the finest sulphate pulp and top grade paper board in the United States—at competitive prices.

U & I Sugar Company, Moses Lake, Wash. In a beet sugar factory, every B.T.U. must be effectively utilized. The Taylor coordinated control panel (*center background*) operates the multiple effect evaporators at maximum capacity, saves fuel, cuts operator attention time, and assures a uniform product.



Entrance to Taylor Instrument Companies' new offices and plant in San Leandro, California. The plant is capable of duplicating many manufacturing and repair techniques previously possible only at the company's main Rochester, N.Y. plant.

Taylor Instruments

MEAN

ACCURACY FIRST

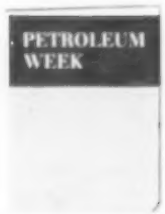
IN HOME AND INDUSTRY

Petroleum Week

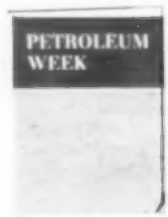
MEETING NEED FOR INDUSTRY-

Acceptance is Immediate!

Petroleum Week is *here*. The long-awaited, much-needed publication that integrates the entire oil industry is a reality—the first magazine designed for specialists and management in all segments of the industry.



Petroleum Week is off to a flying start, having already met the tests of reader and advertiser acceptance. More than half of the initial distribution is paid, and the list of advertisers is impressive and growing fast.

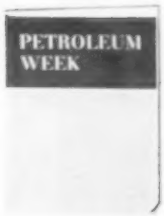


Petroleum Week is written for oil men by oil and business-communications experts. It penetrates every significant level of operation and management . . . covers both the technology of the job and the business of the job.

If you're selling to the oil industry, Petroleum Week is for you. You will want to use PETROLEUM WEEK regularly because everything important in oil is important to Petroleum Week readers. Call the McGraw-Hill office nearest you for additional information.

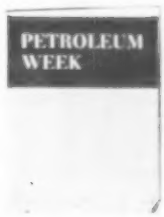
now "on stream"

WIDE, INDUSTRY-DEEP COVERAGE

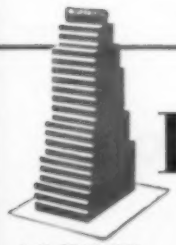


Petroleum Week is the communications center for all interdependent areas of activity — exploration and production, refining, transportation, and marketing. Petroleum Week communicates and cross-communicates . . . keeps each branch of the industry up to date on developments in all phases of oil.

Petroleum Week has a change-of-pace format that spotlights salient points – giving the broad picture in bold, eye-catching type for variable-speed reading. You get the "meat" of the story *fast* and you can change pace anytime you want details.



Petroleum Week is *unique*. It is the only industry-wide, industry-deep publication . . . it is the only cross-communications medium in its field . . . it is the first publication designed from the start around the requirements of the new art of writing for variable-speed, faster and more efficient reading.



PETROLEUM WEEK

330 West 42nd Street, New York 36, New York

A McGRAW-HILL PUBLICATION

Cross- Communications for Men Who Matter in Oil

GOING PLACES *down on the farm with Cities Service...*

The mechanized farm equipment, vehicles, and heating units that make life easier for America's farm families... all depend heavily on Cities Service quality petroleum products.

CITIES SERVICE

A Growth Company

Number 12 of a series

NOW . . . a new universal pipe and block insulation for all temperatures from 100° to 1600° F.

CAREY ALLTEMP

USES—ALLTEMP is recommended for insulating high temperature surfaces such as oil stills, boiler walls, breechings, furnaces and other equipment where surfaces to be insulated reach 1600° F.

Now, answer *all* your insulation problems with a completely *new* pipe and block insulation—Carey ALLTEMP! Eight years of development went into its making. New performance records were set during exhaustive field and laboratory tests. Here it is—*a brand-new industrial insulation* for all temperatures up to 1600° F.

ALLTEMP keeps every last BTU on the job producing power. Its extremely low percentage of shrinkage—approximately ⅓ *less* than other 1200° F. insulation materials—means joints won't open, cracks won't appear in covering. BTU's are *locked in!* ALLTEMP retains its high thermal efficiency and structural strength even after long, continuous exposure to excessive heat and moisture. Non-brittle, it resists blows, abrasions; won't crack or crumble under severe service conditions. And it's easy on the hands—easy to cut, fit, install!

Get all the cost-saving facts on new ALLTEMP today and your copy of the Carey ALLTEMP specification folder.

Just address coupon below.

ALLTEMP RECOMMENDED THICKNESS

Nominal Pipe Size Inches	Temperature Difference °F 80° Air					
	200	400	600	800	1000	1200
	Nominal Thickness, Inches					
1½ & Under	1	1	1½	2	2½	3
2	1	1½	2	2½	2½	3
2½	1	1½	2	2½	3	3½
3	1	1½	2	3	3	3½
3½	1	1½	2	3	3½	3½
4	1	1½	2½	3	3½	4
4½	1½	2	2½	3	3½	4
5	1½	2	2½	3	3½	4
6	1½	2	2½	3½	4	4½
7	1½	2	2½	3½	4	4½
8	1½	2	3	3½	4	4½
9	1½	2	3	3½	4½	5
10	1½	2½	3	4	4½	5
11	1½	2½	3	4	4½	5
12	1½	2½	3	4	4½	5
14 & Over	1½	2½	3½	4	4½	5½

ALLTEMP is available in clean, easy-to-handle flat and preformed blocks. "Nesting" O.D. pipe covering sizes provide accurate, tight fits for multiple layer construction. Only a limited number of "prime" units are necessary for unusual assemblies.

Better Products for Industry Since 1873

Carey

THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio
In Canada: The Philip Carey Co., Ltd., Montreal 3, P.Q.

Carey-approved contract units in major trading areas. Consult your nearest Carey District Office or your Telephone directory.

FREE FOLDER

THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio • Dept. PP-9

Please send free illustrated folder showing specifications, installation details and complete facts on new ALLTEMP insulation.

☐ Have your Industrial Sales Engineer call without obligation.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

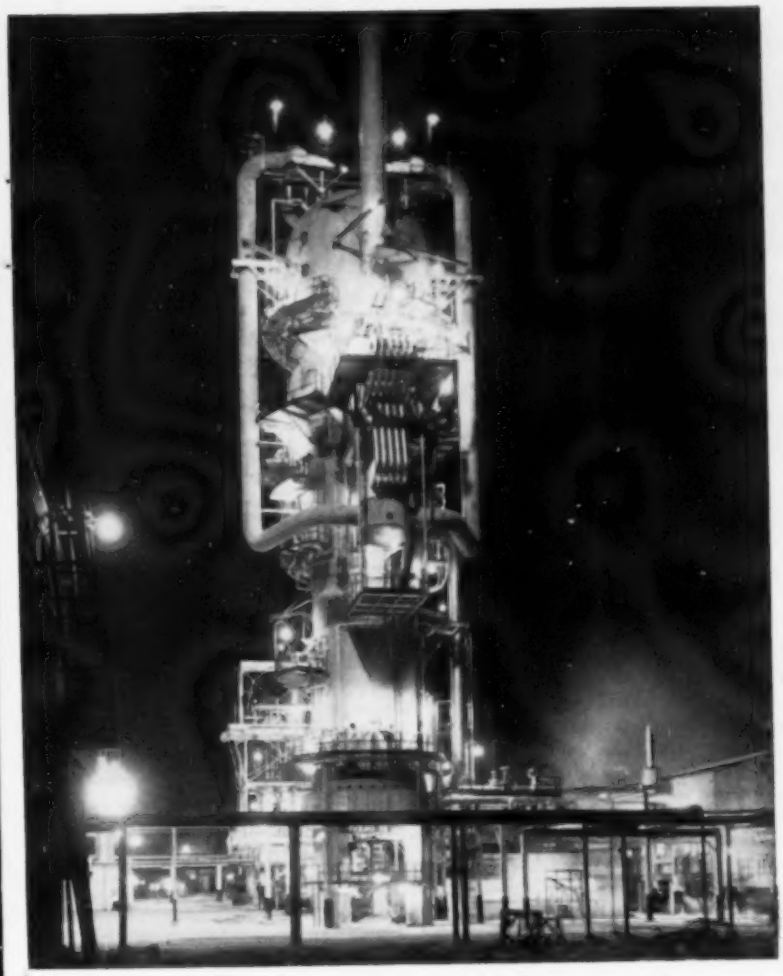
FIRST

IN CAT CRACKING

With over 30 per cent of all crude today eventually becoming cat cracker feed, cat cracker design is increasingly important to refiners. The superiority of the *Fluid* Cat Cracking design is well-established by the fact that 70 per cent of cat cracking capacity in the free world is the fluid design. The M. W. Kellogg Company has engineered or erected more than half of this fluid capacity.

M. W. Kellogg has been in the forefront of Fluid Catalytic Cracking from the beginning. Starting early with continuing studies of catalysts, it worked closely with the industry in engineering the fluid principle. M. W. Kellogg's contribution in mechanical engineering made it possible to design units of capacities large enough to meet accelerated demands for higher octanes since World War II. Its long experience in constructing oil refineries enabled M. W. Kellogg to undertake the erecting of these initial units, and the even larger ones in operation today, with full confidence that they would be on stream in minimum time.

An M. W. Kellogg Fluid Catalytic Cracking unit is your guarantee of many predetermined requirements, including throughput capacity, product quality and quantity, utility cost, catalyst loss, and coke-burning capacity. From its experience in engineering and erecting many side-by-side units, M. W. Kellogg originated



The distinctive vertical construction of M. W. Kellogg's Orthoflow Fluid Catalytic Cracker—a logical development from the side-by-side model—is becoming more and more familiar on refinery skylines. Orthoflow units completed or under construction since 1951 already represent a total throughput of over 290,000 BPD.

the straight-line Orthoflow* design—which offers many extra economic advantages.

A full-color, 13-minute movie, showing how the Orthoflow works, is now being booked for showings after July 1. Return coupon for particulars and to obtain a copy of our No. 2, 1955 Kelloggram which illustrates a recent Orthoflow installation.

Refinery Process Division

THE M. W. KELLOGG COMPANY

225 Broadway, New York 7, N. Y.

The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corp., London

SUBSIDIARIES OF PULLMAN INCORPORATED

*Trademark of The M. W. Kellogg Company

Refinery Process Division
The M. W. Kellogg Company
225 Broadway, New York 7, N. Y.

☐ Send available dates for showing of your new Orthoflow film.

My preference after July 1 is (1) _____ *(2)* _____

☐ Send Kelloggram illustrating recent Orthoflow installation.

Name _____
(Title if any)

Company _____

Address _____

PP-9

FOR TEL ADDITION, would you select this 25-HP LIGHTNIN with standard flange-mounted motor? Instead of a stuffing box, this mixer has a quickly-replaceable rotary seal cartridge that eliminates repacking, entirely, and is lubricated by the liquid in the tank.

FOR BLENDING CRUDE would you choose a unit like this? It's a 25-HP LIGHTNIN, equipped with a standard foot-mounted motor and a packed stuffing box designed for pressures to 150 psig.

How to match any given set *of mixing or blending conditions*

Which mixer would *you* specify for a big blending job?

These pictures show just *two* ways you can buy LIGHTNIN Mixers to suit a specific mixing or blending operation.

There are many, many more ways to do this. For example:

MOTORS. You can order LIGHTNINs with the motor that gives you best service and minimizes your stock requirements: any make with NEMA frame; any current characteristics; any enclosure or insulation.

DRIVES. You can choose a highly efficient gear drive, or a lower-cost V-belt drive, for power input to the mixer. On gear drive LIGHTNINs, you can have a fluid coupling between motor and drive to handle excessively high starting torques.

SHAFT SEALING. You can specify the new rotary seal mentioned above (it's saving many oil companies several thousand dollars a year on maintenance). Or you can have your pick of *four* standard packed stuffing boxes, two of which permit repacking without draining the tank.

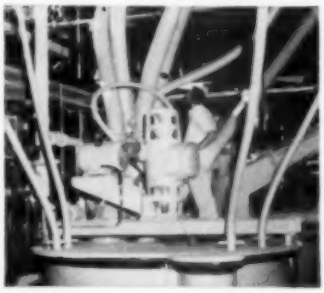
SIZES. You have a full range of sizes to choose from—18 basic models, 1 to 25 HP—so you get a mixer closely fitted to your needs.

MATERIALS. And you can write your own ticket on corrosion-resistant materials for shafts and propellers. You can get these wetted parts in *any* machinable metal or alloy—and with special covering if you want it.

You don't pay more for this freedom of choice. You *save*—because you cut your mixer operating, maintenance, and parts-stocking cost for *as long as the next 20 years.*

That's why it pays to look for the mixer that gives you *most choice* for the money.

Your LIGHTNIN Mixer representative will help you find it—quickly, without obligation. His name is in your copy of Refinery Catalog. Why not call him today?



GET THE ONE correct flow pattern that can give optimum fluid mixing results—with turbine-type LIGHTNINs for open or closed tanks. Hundreds of power-speed combinations are available, in sizes from 1 to 500 HP. Results guaranteed.

OPEN TANK becomes an efficient mixing vessel when you add a LIGHTNIN Mixer. Propeller unit, one of 30 models ranging from ¼ to 3 HP, tumbles and rotates the batch rapidly to achieve uniformity in least possible time.

Get these helpful facts on mixing: cost-cutting ideas on mixer selection; best type of vessel; installation and operating hints; full description of LIGHTNIN Mixers. Free—no obligation. Just check data you want, tear out and mail to us today with your name and company address.

- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller types)
- ☐ B-104 Side Entering Mixers
- ☐ B-107 Mixing Data Sheet
- ☐ B-108 Portable Mixers (electric and air driven)
- ☐ B-110 Condensed Catalog (complete line)
- ☐ B-111 LIGHTNIN Rotary Mechanical Seals
- ☐ B-112 Laboratory Mixers

MIXING EQUIPMENT Co., Inc., 131-i Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

***Lightnin®* Mixers**

MIXCO fluid mixing specialists

Petroleum Processing
SEPTEMBER 1955

TYPIFYING TOLEDO COOPERATION, four oil men from as many refineries, mainstays in Toledo's . . .

Operation 'Cooperation'

How four refiners in Toledo work together to promote the oil industry in their area

OIL Progress Week is only about a month away —Oct. 9-15. This is the time each year when we in the oil industry do everything we can to tell the public all about ourselves, how big we are, how many businesses we represent, what we do to bring crude "black gold" from the ground to the consumer.

Where does the refiner fit in? Unlike the marketer who meets the public daily, the refiner works behind the scenes. How can he help the general public learn and understand what makes petroleum processing tick?

Perhaps the "Toledo Story" will help. This is a story of how the four big refining companies in Toledo, Ohio, have been working together successfully since 1951 in a program to promote the industry and its value to Toledoans. It is a story of what might be done in almost any area in the country, large or small, where refineries carry on their daily business in a common region meeting the same general public.

Four important factors keynote the Toledo story. Some have not been an essential part of the Oil Progress Week activities, but rather have taken place at other times of the year. However, they represent the kind of thing refiners can do continuously on a year-round basis.

1—The "Oil Man for a Day" and "Oil Woman for a Day" projects.

2—Business-Industry-Education (B-I-E) Day.

3—Education-Business (E-B) Day.

4—Constant cooperation by refiners with other industries, civic officials, service clubs, youth groups, and other organizations.

How did this Toledo cooperation get started? How is it working today? Here is that story, as told by Edward P. King, ass't. superintendent in charge of personnel at one of the four Toledo refineries, Sun Oil Co., and current chairman of the Lucas County Oil Industry Information Committee.

Refiners have benefited too in this program. As pointed out by Mr. King: "Perhaps the greatest single benefit we have derived from OIIC participation has been the tremendous upsurge in employe morale. A real sense of pride in being an oil industry employe has been developed through their participation in plant tours, acting as guides, learning more themselves about the company and the industry, and hearing neighbors in the community talk favorably about their employers and their industry.

Mr. King's story starts on next page ►

* L. to R: E. D. Collins, Gulf, chairman of the Area OIIC; Steve Stone, Pure, and Frank Black, Sohio, coordinators; and E. P. King, Sun Oil, Lucas County OIIC chairman, and author of this article (See "Meet the Author," p. 1300).

Toledo Story—Operation Cooperation

By EDWARD P. KING
Sun Oil Co.

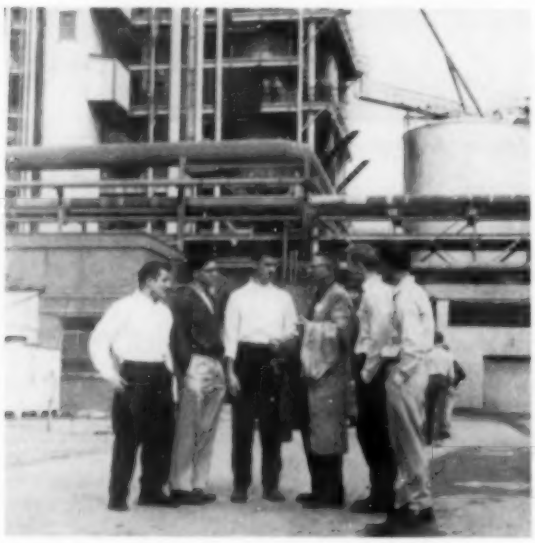
SINCE before the turn of the century, the oil industry has played a vital part in the growth and progress of Toledo, Ohio. Not only does it contribute directly to area economics by the employment of about 5000 men and women, but it has been an important motivating factor in bringing other industries to the area.

Yet most Toledoans knew very little about the industry—and cared less. Even oil company employes had little or no conception of the size and importance of their own industry in Toledo. They had no way of knowing, because no one had bothered to tell them.

Each company—with one eye on operating costs and the other on their competition—believed it was doing a good job in giving customers the best value for their dollar they could get anywhere. Employes received high wages, liberal fringe benefits, and safe working conditions.

Wasn't this enough? Up until a few years ago, we Toledo oil men thought so. Some of us held a plant tour once in a while for a local service club or civic group. Occasionally, one of us would provide a luncheon or a dinner speaker, or send a representative to a local high school to talk about career opportunities in our own company.

We were complacent. Public relations seemed to us much like advertising in a way—a chance to get our own good points over to the public and steal a march on our competition.



HIGH SCHOOL SENIORS start refinery tour. Sun Oil guide Jack Cordrey (coat over arm) greets them

LEARNING HOW REFINERY IS CONTROLLED. Another group of "oil men for a day" with Sun Oil guide John Jaynes

Oil Men and Women for A Day

ONE of the most successful activities in Toledo's "Operation Cooperation" was the "Oil Man for a Day" program, inaugurated in 1951 and held annually during Oil Progress Week ever since.

Last year, 400 outstanding high school seniors were selected by their principals in all Lucas County high schools. Each was assigned to one of the four refineries. They assembled at a central location in the city and were taken by bus to the plants.

At each plant, the refinery manager and other officials greeted the students and gave them a brief description of petroleum refining. The students then toured the refinery in groups, seeing close at hand the things they had been told about. Following the tour, the group had a lunch, saw a "Magic Barrel" demonstration, an OIIC motion picture, and received literature kits and souvenirs.

As a follow-through, each student returned to his class and reported on his experiences as an "Oil Man" and what he learned about the industry.

The "Magic Barrel" demonstration is another example of the cooperative effort in the Toledo program. It is a visual demonstration of the variety of petroleum products that contribute to the nation's high standard of living. Exhibits are housed in a full-size aluminum oil drum which opens in half lengthwise. From within, the demonstrator brings forth an amazing variety of petroleum-

and we were all satisfied to go our own separate ways. Admittedly, there seemed to be some fear of public sentiment being directed against us if we cooperated with each other, particularly at the local level.

Then, the first Oil Progress Day was born back in 1946 when a nation-wide public opinion survey revealed that most Americans held erroneous and often damaging ideas about the oil business. The Oil Industry Information Committee program was inaugurated by the American Petroleum Institute. Oil Progress Day was set up as a time when oil men could concentrate on telling the industry's story in their own communities.

In Toledo, as elsewhere, it was soon recognized that one day was not enough. So the program was expanded to Oil Progress Week in October of 1949, and such it has been ever since.

It was not until 1951 that each of the four refineries in Toledo were represented—Gulf Refining Co., Sun Oil Co., Pure Oil Co., and Standard Oil Co. (Ohio). Up to that time most of the members of the Lucas County OIIC were marketing people. Credit to the refiners for instilling new life into the program was given recently by Edward D. Collins, chairman of the area OIIC and ass't. district manager for Gulf in Toledo:

"That was the year we had the parade," he recalled, "and in some ways it marked the real start of our OIIC undertakings in Toledo. And I'll be the first to admit that it was not until we got some of the refinery people interested that we really got the ball rolling. In fact, I believe one of the finest things to come out of this OIIC program has been the development of such close cooperation between the marketers and refiners in our business."

What kind of an organization is needed? Just how do the various refinery managers cooperate? The set-up is relatively simple. Without a doubt, the success in Toledo has been due primarily to excellent management cooperation and an efficient organization.

Refinery managers and sales man-

(*Continued on next page*)

THERE ARE OIL WOMEN TOO. High school girls watch Sun switchboard operators Helen Smothers, Margaret McClinton

IN FIRST AID as well as office. Helen Bersticker, Sun nurse, explains her job to two Toledo seniors

derived products, including an exhibit of the actual manufacture of synthetic rubber.

Developed by du Pont, the exhibit is made available to oil companies at cost. Each of the Toledo refineries bought one. However, the demand for demonstrations has been so great that often a request comes to one refinery for the barrel when it is already scheduled. In such cases, the refinery OIIC Magic Barrel representative merely passes the request along to his counterpart at one of the other refineries.

One point is settled early in this and similar programs —standardization on luncheon and souvenirs. In order to take some unnecessary competition out of the picture and prevent pure product promotion, agreement was reached on an in-plant luncheon and similar automatic pencils for all the souvenirs.

Another program for high school seniors—but for girl students—is the "Oil Woman for a Day" program. It is conducted along the same lines as "Oil Man for a Day."

A major difference from the boys' program is that during the morning each student is turned over to a woman employe, frequently a member of the Desk and Derrick Club, to learn about the opportunities for women in the oil industry. The Desk and Derrick Club consists of oil industry women—secretaries in sales offices and

(*Continued at bottom of next page*)

agers actively coordinate the programs within their own companies and designate employes as representatives on the various OIIC Committees. These representatives in turn appoint other committee members. Committees work out details of the various projects and submit them to their top management representatives for their final approval.

Typical of the people serving on committees are these, the members of the Lucas County OIIC (including people from not only the four refineries but also various marketing companies):

Gulf—Forrest D. Miller, real estate, sales; George Blanchard, industrial relations.

Sohio—James Wyper, sales office manager; Frank Black, industrial relations.

Sun—Koerner Lutz, ass't. superintendent; E. P. King, personnel; Regina Glasco, secretary to refinery ass't. manager.

Pure—Steve Stone, training supervisor; Kenneth Gilson, staff assistant.

Howe-Weiss — Harry B. Robson, sales manager.

Ohio Oil—David Magee, special assistant.

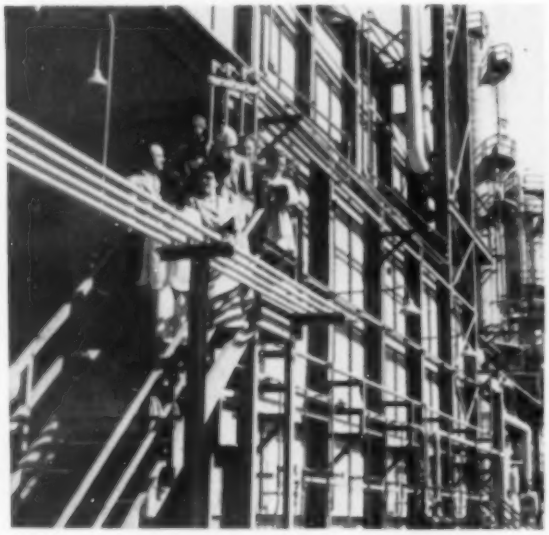
Sinclair — Maynard Simon, ass't. district manager.

Several of these members serve also on the Area OIIC, which is advantageous in coordinating county projects with others in the surrounding area. All members are elected to serve a two-year term.

Some details on several of the larger projects representing Toledo's "Operation Cooperation" are given on these and the following pages.

Toledo refiners have a big part in a program the OIIC originated in Ohio last year—the loaned executive experimental plan. Toledo helped break ground on this project, which now is in full swing in 23 states. Of seven men from Ohio refineries who are members of the "Flying Squadron" this year, three are from Toledo.

The program consists of selecting young men with leadership qualities from each area and assigning them to an OIIC training program. After inten-



GOING UP TO GET THE LOW-DOWN on refining. Guide Wilford Neeb describes process equipment to a group of teachers

FIRE FIGHTING IS IMPORTANT to the refiner, these teachers learn from Sun safety engineer James Hull

Teachers Learn from Refiners . . .

refinery offices, technicians and those in other positions.

Instead of a Magic Barrel, the girl students see a "Magic Suitcase." This is another du Pont-developed exhibit but in a suitcase. It is beamed particularly at women, and shows a large variety of synthetic fibers which have been developed from petroleum derivatives.

Another direct result of Toledo's Operation Cooperation, though not necessarily a part of Oil Progress Week, has been B-I-E Day and E-B Day.

B-I-E (Business-Industry-Education) Day is an annual affair sponsored by the Toledo Chamber of Commerce and participated in by OIIC. Its purpose is to enable teachers to see the free enterprise system in action and to help them better guide their students to fit themselves for industrial careers.

The event is usually held in early October during the week prior to Oil Progress Week. All Toledo schools are closed for the day and teachers are assigned to individual industrial or business firms.

At the refinery, the teachers are welcomed by management, given a brief description of refining technology, and then split into small groups of five or six and introduced to their guides.

Refinery personnel other than tour guides are brought into this program. One week before the tour, notices are posted on bulletin boards advising all employes of the

sive schooling in the OIIC program itself, in public relations techniques and in committee organization, each man is assigned to an area OIIC chairman. Aim of the program is to provide a corps of capable young men who will be good material for their own individual OII Committees.

The OIIC program has been tremendously worthwhile in Toledo. Someone has said, "Only people who know you well will think well of you." This is true, we have found, of our neighbors in our plant communities, but is equally true, of course, of our own employes.

In uncounted ways, Operation Cooperation in Toledo has paid off in handsome dividends.

Meet the Author

Edward P. King, assistant superintendent in charge of personnel, Sun Oil Co., Toledo, Ohio, refinery, is a big man in more ways than one. He is 6 ft. 4 in. tall and weighs 235 lb. He is chairman, Lucas County OIIC. Members of his community credit his tremendous enthusiasm, leadership and organizing ability as the principal reasons for the outstanding success of the committee in Operation Cooperation.

Born in Toledo in 1905, Mr. King was graduated from Toledo University. After joining Sun in 1932, Mr. King held a variety of jobs in maintenance and operations and was made personnel manager in 1941. He was appointed to his present position in 1944.

He is active in the Chamber of Commerce, Nat'l. Ass'n. of Foremen, Foreman's Club of Toledo, Toledo Personnel Managers Ass'n., YMCA, Junior Achievement, Red Cross, Community Chest, March of Dimes, Toledo Zoo, and Toledo Art Museum.

REFINERY ENGINEER WITH FELLOW-PUPILS. Sun's Lawrence Kumnick arrives for a day at Lincoln grade school in Toledo

LISTENING TO TEACHER. With other refinery men, Mr. Kumnick sits with a group in Lincoln School's sightsaving class

. . . and Refiners Go Back to School

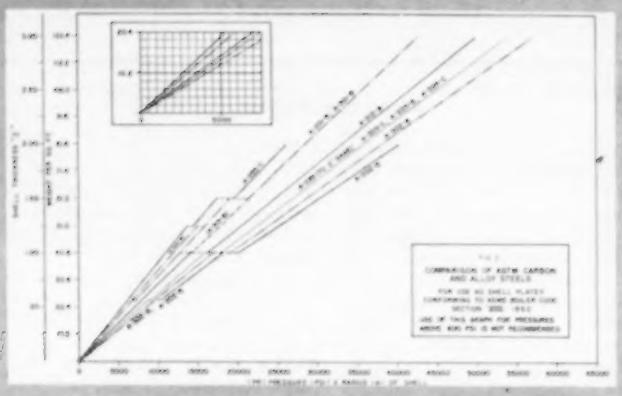
event and listing the names and affiliations of the visitors. Each employe is thereby impressed with the fact that he is a host for the day.

A switch on the B-I-E Day idea is Education-Business (E-B) Day, held each spring as a part of Toledo's Operation Cooperation. Although held sometime during April in the Toledo OIIC program, the affair could easily be made a part of Oil Progress Week if a community so desired.

In this activity, representatives from business and industry spend a day visiting the schools where they watch students showing what they have learned and are learning.

In the pictures above, a refinery engineer, Lawrence Kumnick of Sun Oil Co., along with his counterparts from other refineries and industrial operations, is getting a real education by "going back to school for one day."

As in the case of B-I-E Day, arrangements are made directly between the Chamber of Commerce and the Lucas County OIIC. This eliminates the need for making individual arrangements with the four refining companies as well as the six other oil firms participating—Fiske, Gulf, Howe-Weiss, Miller, Ohio, Pure, Shell, Sinclair, Sohio, and Sun. There is a representative of the county OIIC on the Education Division of the Chamber, and it is his job to make all arrangements with the various oil company representatives.



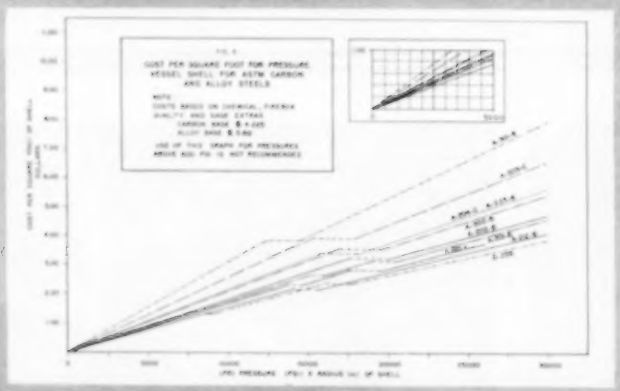
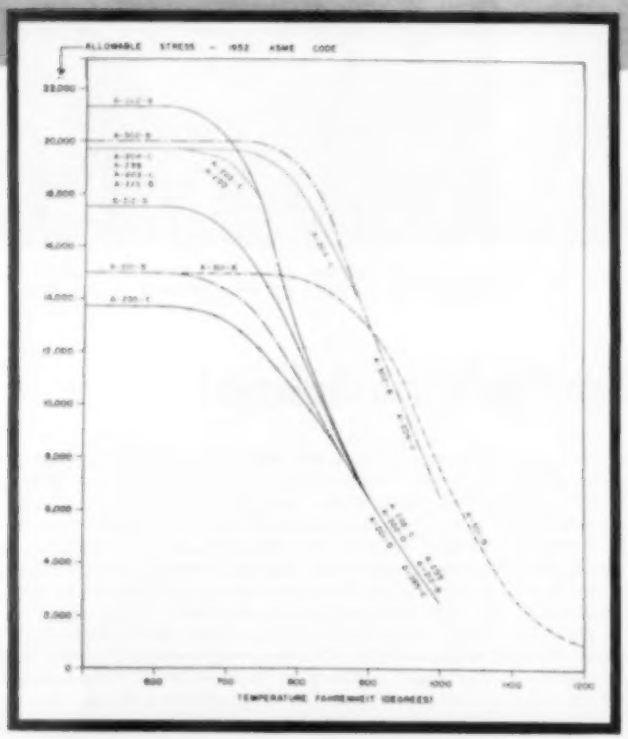


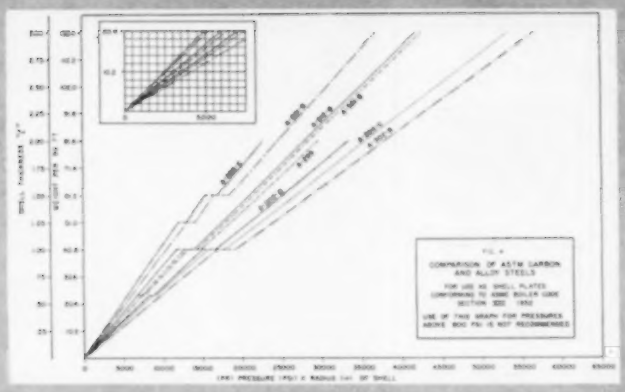
FIG. 2 and FIG. 3—Comparison charts for steels at maximum service temperature of 650 Fahrenheit



Commonly Used Steels for Pressure Vessels

A-201-B Carbon-silicon steel plate of intermediate tensile ranges
A-202-B Chromium - manganese - silicon alloy steel plate
A-203-C Nickel steel plate
A-204-C Molybdenum steel plate
A-212-B High tensile, carbon-silicon steel plate
A-225-B Manganese - vanadium steel plate
A-285-C Low and intermediate tensile strength carbon steel plate
A-299 High tensile strength carbon-manganese-silicon steel plate
A-301-B Chromium-molybdenum (high temperature) steel plate
A-302-B Manganese - molybdenum steel plate

FIG. 1—ALLOYS ARE STRONG in the upper temperature ranges. Graph at left shows code design stress versus temperature for steels shown in the list above



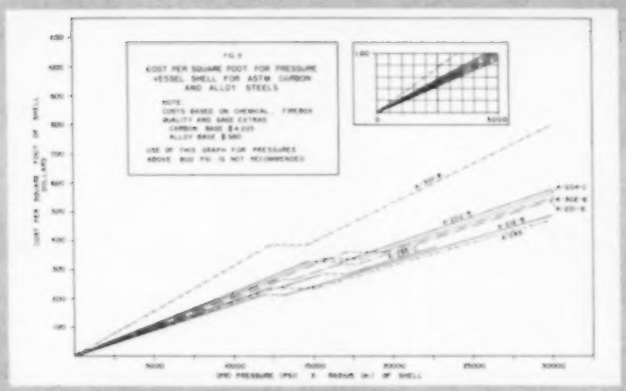


FIG. 4 and FIG. 5—Comparison charts for steels at maximum service temperature of 750 Fahrenheit

In Pressure Vessel Design

When to Use the Alloy Steels

By WILLIAM H. FUNK
Lukens Steel Co.

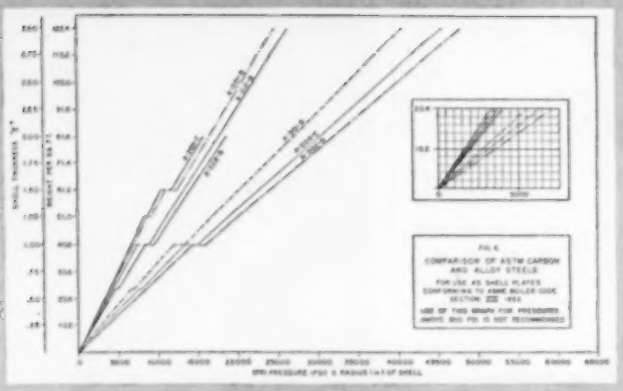
DESIGNERS of pressure vessels today face somewhat of a mixed blessing in the large variety of steels available for fabrication.

On the one hand, the variety is a definite boon in permitting the designer choice of the most economical material to match most service requirements. But on the other hand, this very diversity and the scattered sources of information about the steels often make their selection confusing.

The four sets of graphs accompanying this article are designed to help combat this problem. They are aimed as tools to assist the designer in obtaining the most efficient combination of economy and weight in his equipment planning.

The question is to determine where in the temperature ranges encountered it is more economical to use alloy than to use carbon steels. It is well recognized that the alloy steels in general have higher allowable tensile strength than carbon steels, particularly in the upper temperature ranges, as shown in Fig. 1. This implies that, while the alloy steels may have higher initial costs than the carbon steels, there will be a point at which their thinner gages, by virtue of greater strength, will provide weight savings of sufficient substance to more than offset their cost. Furthermore, cost of fabrication will also have a direct bearing on the economics, although it is not discussed in this article.

There are four pairs of graphs for selecting the proper steel. Each pair is for a temperature range as indicated: to 650° F. maximum, 750° F. maximum, 850° F. maximum, and 950° F. maximum. In each pair, one graph gives the thickness and the



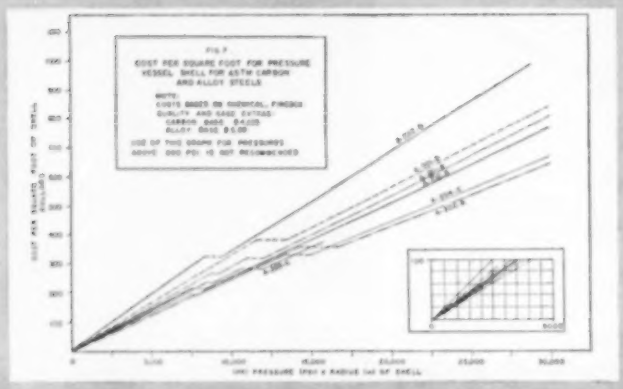


FIG. 6 and FIG. 7—Comparison charts for steels at maximum service temperature of 850 Fahrenheit

When to Use Steel Alloys—Continued

weight/sq. ft. for various grades of carbon and alloy steels based upon the code requirements for the vessel radius and pressure and temperature service conditions. The other graph gives the cost/sq. ft. on the same basis.

To use the graphs, it is first necessary to determine the *"PR"* term for the pressure vessel. This *PR* term is used in formulas in the American Society of Mechanical Engineers code for Unfired Pressure Vessels. For example: the formula: $t = PR/(SE-0.6P)$ is used to calculate the thickness of a shell of a vessel under internal pressure. This is obtained by multiplying the radius of the vessel in inches by the pressure in psi.

For example: a fabricator has to build a vessel 200 inches in diameter. It is to withstand a pressure of 100 psi. at a temperature of 500° F. (See Fig. 2). Multiplying the pressure, *P*, by the radius, *R*, the *PR* term comes to 10,000.

Using this figure, refer to Fig. 2 to find the thickness of the shell for each steel and the weight/sq. ft. of shell. This will indicate the weight savings to be gained through the various grades of steels.

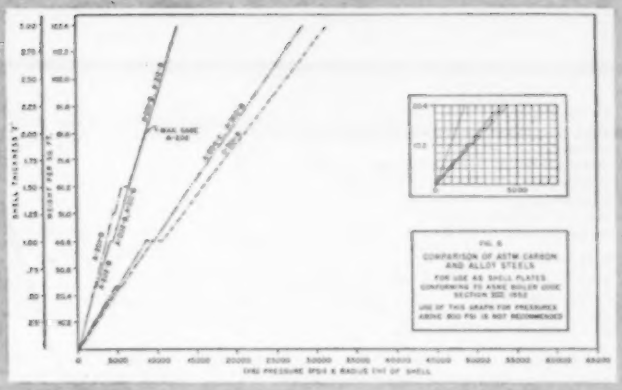
It becomes apparent that for the pressure vessels operating in this range (up to 650° F.), the alloys A-202 and A-302 offer the greatest savings in weight as compared with the other materials shown in the chart. Their weight/sq. ft. as a result of the reduced allowable gage runs in the neighborhood of 24 lb. For comparison, the weight/sq. ft. for A-285-C Firebox steel is 36 lb.

However, certain of the carbon steels will show only 2 to 3 lb. more required weight per sq. ft. than these alloys. Take, for example, the A-299, silicon killed steel. Referring to Fig. 3, using the same 10,000 for the *PR* term, it will be seen that the A-299 costs approximately 30¢ less per sq. ft. (about 16%) of vessel shell than do the alloys, yet it increases weight only 2 lb./sq. ft., or 7%.

This is a borderline case. However, it approximates the point at which the alloy steel should be considered for pressure vessel design. In this particular situation, depending upon the importance of weight, either the A-299 or one of the two alloys might be specified.

If reduction in weight would have a large bearing on transportation costs or if limitations of shop or field erection equipment were important considerations; then it is likely that the advantage would lie in the selection of either A-202 or A-302.

As temperatures go up, it will be noted that the balance tends to lean more in favor of the alloy steels. At an operating temperature of 850° F., alloy steels are superior not only in weight savings but also in initial cost. A-302-B or A-204-C are the steels that



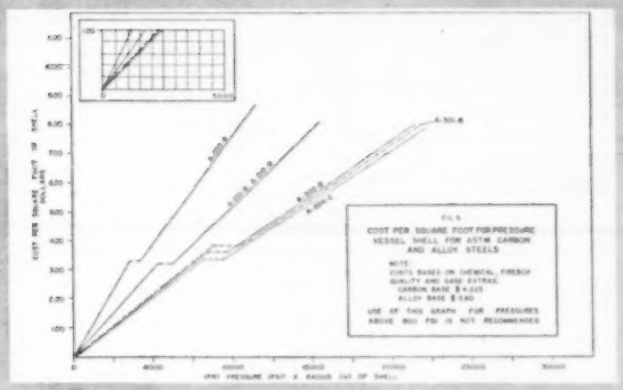


FIG. 8 and FIG. 9—Comparison charts for steels at maximum service temperature of 950 Fahrenheit

therefore might well be selected.

When 950° F. is reached, the carbon steels as well as A-202-B have to be in gages up to three times that of A-301-B to bear the same load. Furthermore, A-285-C cannot even be used in this range for pressure vessels. Generally speaking, the chrome-moly steel, A-301, is recommended for this range and on up to 1200° F. Although it costs slightly more than A-204-C and A-302-B, it is more resistant to graphitization—an important factor in a number of refinery processing vessels.

A note regarding the graphs: the break, or step, in the lines results from the fact that increased joint efficiencies were taken into account at the appropriate gages where the code requires X-raying and stress-relieving. The cost charts were computed using chemical, gage, and quality extras only: other extras would in most instances apply to all the steels.

Meet the Author

William H. Funk, manager of technical service, Lukens Steel Co., Coatesville, Penna., is a native of Phoenixville, Penna., and a graduate of Drexel Institute of Technology, Philadelphia. He joined Lukens over 16 years ago as a design engineer in the Lukenweld Division.

For a period immediately after World War II, Mr. Funk was a sales engineer for that division. Then he became assistant manager of development engineering. One year ago, he was appointed to his present position.

Foreign owned refineries

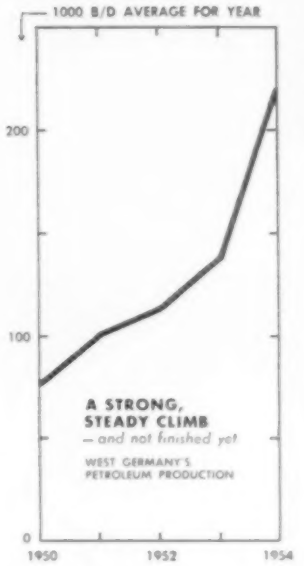
1. British Petroleum Benzin- und Petroleum- G.m.b.H., Hamburg
2. Deutsche Shell A.G., Hamburg-Harburg
3. Deutsche Shell A.G., Rheinland
4. Deutsche Vacuum Oel A.G., Bremen
5. Esso A.G., Hamburg-Harburg
6. Oelwerke Julius Schindler G.m.b.H., Hamburg

German owned refineries

7. Badische Anilin- und Sodafabrik A.G., Ludwigshafen
8. Deutsche Erdoel A.G., Heide
9. Deutsche Erdoel A.G., Wietze Krs. Celle
10. Deutsche Gasolin A.G., Dollbergen
11. Gewerkschaft Deutsche Erdoel-Raffinerie, Deurag-Nerag, Misburg
12. Gewerkschaft Erdoel Raffinerie, Emsland, Lingen
13. Gewerkschaft Grieff Bergbau Mineraloelraffinerie, Dollberben
14. Kraftstoff Handelsgesellschaft m.b.H., Essen
15. Mineraloel- und Asphaltwerke A.G., Ostermoor
16. Mineraloelwerke A. Sengewald, Dedenhausen
17. Mineraloelwerke Peine, Peine
18. Ruhrbau G.m.b.H., Muelheim-Ruhr
19. Ruhrchemie A.G., Oberhausen-Ruhr
20. Ruhroel G.m.b.H., Bottrop-Ruhr
21. Wintershall A.G., Salzbergen
22. Zeller und Gmelin, Mineraloelraffinerie, Eislingen-Fils

Hydrogenation plants

23. Gelsenberg Benzin A.G., Gelsenkirchen
24. Scholven-Chemie A.G., Gelsenkirchen
25. Union Rheinische Braunkohlen-Kraftstoff A.G., (Shell) Wesseling



SIX-FOLD INCREASE SINCE 1948 is represented by this map of West Germany's petroleum processing industry today

West German Refining . . .

A 600%+ Increase in Capacity

A Report by the Editors of PETROLEUM PROCESSING

TOTAL petroleum processing capacity in West Germany for 1955 is estimated at about 244,000 b/d, more than a six-fold increase within the last seven years.

Prewar German processing capacity was only about 47,000 b/d, and over half of this was destroyed during World War II. Six synthetic fuel and four coal hydrogenation plants were also damaged or dismantled.

Over $238 million[1] has been invested in the expanding West German petroleum processing industry, with rebuilding starting within the framework of general West European reconstruction aimed at making the OEEC[2] nations independent of expensive dollar-imports of finished products. The success of this program is attested by the rapid increase in West German petroleum processing capacity since 1948.

Before World War II, over 75% of Germany's demand for petroleum products was imported from abroad in the form of finished products. Germany's prewar domestic facilities consisted of special plants for the production of lubricating oils and asphalt, as well as one thermal cracking plant.

By means of comparison, figures for individual companies on the rated capacity for late 1954—about 215,400 b/d—are given in Table 1. Today there are 22 refineries and 3 hydrogenation plants having 12 cracking units, 3 reforming units and 3 hydrogenation units.

Refineries and Capacities

The structure of West Germany's refining industry is fairly unusua within the European framework. O the large international petroleum companies usually dominating th European refining industry, only fou

(1) From report by Rhenish-Westphalian Institute for Economic Research in Essen, Germany.

(2) OEEC—Organization for European Economic Cooperation—includes Austria, Belgium, Denmark, France, West Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Holland, Norway, Portugal, Sweden, Switzerland, Turkey and Great Britain.

Table 1—West German refining capacity at end of 1954

	Plant charge capacities		Processing capacities thousands of metric tons/yr.		
	bbls. per calendar day[1]	thousands of metric tons/yr.	Cracking[2]	Reforming	Hydrogenation
Foreign Refining Companies (Total capacity)	**101,700**	**5,240**	**1,140**	**230**	
Esso A.G., Hamburg-Harburg	36,900	1,900	165 T		
Deutsche Shell A.G.[3], Hamburg-Harburg	21,300	1,100	450 T		
Oelwerke Julius Schindler G.m.b.H., Hamburg	3,900	200			
British Petroleum Benzin- und Petroleum-G.m.b.H., Hamburg	25,800	1,330	165 T	230	
Deutsche Vacuum Oel A.G., Bremen	13,800	710	360 C		
German Refining Companies (Total capacity)	**58,400**	**3,015**	**1,110**	**70**	
Deutsche Erdoel A.G., Heide	12,600	650	360 C		
Gewerkschaft Deutsche Erdoel-Raffinerie, Deurag-Nerag, Misburg	11,200	575	100 T		
Gewerkschaft Erdoel Reffinerie, Emsland, Lingen	10,700	550	550 C		
Deutsche Gasolin A.G., Dollbergen	2,200	115			
Wintershall A.G., Salzbergen	1,900	100			
Ruhrchemie A.G., Oberhausen-Ruhr	5,400	280	100 C	70	
Ruhrbau G.m.b.H., Muelheim-Ruhr	5,800	300			
Ruhroel G.m.b.H., Bottrop-Ruhr	2,300	120			
Eight smaller plants[4]	6,300	325			
Hydrogenation Plants (Total capacity)	**55,300**	**2,850**	**950**	**390**	**1,070**
Gelsenberg Benzin A.G., Gelsenkirchen	25,200	1,300	{ 40 T } { 450 C }	290	500
Union Rheinische Braunkohlen-Kraftstoff A.G., Wesseling	15,500	800	220 T		330
Scholven-Chemie A.G., Gelsenkirchen	14,600	750	240	100	240
Totals (all companies)	**215,400**	**11,105**	**3,200**	**690**	**1,070**

[1] Assuming one metric ton of crude oil equals 7.084 barrels crude—from American Petroleum Institute's "Petroleum Facts and Figures," 11th ed., 1954, p. 303.
[2] For cracking, letter "T" denotes thermal and letter "C" denotes catalytic.
[3] Deutsche Shell A.G. has another refinery at Rheinland.
[4] Includes the following: Kraftstoff Handelsgesellschaft m.b.H., Essen; Mineraloel- und Asphaltwerke A.G., Ostermoor; Badische Anilin- und Sodafabrik A.G., Ludwigshafen; Deutsche Erdoel A.G., Wietze Krs. Celle; Gewerkschaft Grieff Bergbau Mineraloelraffinerie, Dollbergen; Mineraloelwerke Peine, Peine; Mineraloelwerke A. Sengewald, Dedenhausen; and Zeller und Gmelin, Mineraloelraffinerie, Eislingen-Fils. (See map.)
Note: Data from Rhenish-Westphalian Institute for Economic Research, Essen.

are represented in West Germany. These are Esso, Shell, British Petroleum and Socony Mobil, representing less than half of total West German refining capacity with their six refineries. In contrast there are 18 German companies owning 16 oil refineries and 3 hydrogenation plants representing over half of West German refining capacity.

Purely German petroleum companies that have expanded old, prewar plants and have added two large modern plants are Refinery Lingen in Emsland and Refinery Heide in Schles /ig-Holstein.

Over one-third of all West German capacity is represented by plants in the Rhine-Ruhr area. These companies are usually closely connected—as regards financial and corporate ties—with Rhine and Ruhr area hard and brown coal companies. These plants are principally the three former coal hydrogenation works—Gelsenberg-Benzin, Union Wesseling, and Scholven-Chemie. These plants have remodeled their production facilities so that the petroleum, after top-distillation, is cracked and the residue (topped crude) is turned into gasoline and diesel oil via the hydrogenation process.

There are three smaller refineries in the Ruhr area—Ruhrbau, Ruhrchemie and Ruhroel. Ruhrbau has distillation and catalytic desulfurization units, Ruhroel has top distillation and thermal reforming installations, and Ruhrchemie has catalytic cracking and reforming units.

Polymerization is also used by Deutsche Erdoel AG, Duerag-Nerag, Gelsenber, Wesseling, Scholven, and Lingen.

Lubricating oils are processed by Badische Anilin- und Sodafabrik, DEA, Deurag-Nerag, Esso, Gasolin, Shell Harburn, Shell Rheinland, Schindler, Vacuum, and Wintershall.

About one-third of all crude oil refined in Germany is domestic in origin.

Table 2—West German Production of Petroleum Products

(Barrels per stream day of product*)

	1950	1951	1952	1953	1954
Liquid gas	1,270	2,100	2,830	4,610	6,360
Gasoline	22,660	35,370	40,050	48,160	60,550
Jet fuel	1,800	1,800	1,040	960	960
Turbine fuels				140	38,630
Diesel fuels	11,470	24,650	29,130	36,650	47,420
Lubricating oils	10,530	7,150	7,380	7,520	6,620
Fuel Oil	9,550	15,570	17,250	19,580	32,800
Asphalt	6,460	6,870	7,640	7,870	9,960
Petroleum coke	500	570	800	1,190	2,560
Others	2,100	2,560	3,790	6,210	8,270
Total	**66,340**	**96,640**	**109,910**	**132,890**	**214,130**

* Conversion from metric tons to barrels using American Petroleum Institute's "Petroleum Facts and Figures," 11th ed., 1954, p. 303.

NEW CATALYTIC cracking plant at Esso A.G., Hamburg-Harburg

MODERN central control room of Esso A.G., Hamburg-Harburg

PLATFORMER at British Petroleum Benzin-und Petroleum-G.m.b.H., Hamburg

The other two-thirds are imported. About 15% of the imports are from Venezuela and Mexico, the rest from Iraq, Saudi Arabia and Kuwait.

Equipment and Processes

Germany's refining industry has, thus far, not developed new processes or machinery that could be called typically "German" or "new." The industry was rebuilt to a large extent under American and British technical guidance and direction, as well as with foreign capital—some of it from private companies, some from Marshall Plan, ECA, MSA funds.

Some refinements to existing processes have undoubtedly been added, such as the Fischer-Tropsch process and allied synthesizing processes, as well as the use of improved catalysts. But by and large, little or no independent progress has been recorded in this field.

It is possible that as the Germans catch up with British and American refining methods, they will go on to develop methods and equipment of their own design. But present machinery, whether German-made under foreign license, or imported directly from abroad, parallels typical American and British installations.

Production and Markets

Production of petroleum products has shifted somewhat during the past four years in West Germany. The so-called heavy products, like lubricating oils and asphalt, have held their own. Production of fuel oil has increased some, but production of gasoline for motor vehicles has more than doubled and that of diesel oil more than tripled.

Quality of German petroleum products, in the eyes of both German and foreign experts, is "average to good." Octane ratings are from 79 to 85 for "normal" gasoline and up to 91 for

Fast Rise Like Japan

West German refining capacity has risen rapidly, much like the rise in Japanese refining capacity reported in last month's issue ("Japanese Refining Booms," pp. 1139-1142).

As indicated in the accompanying story, West German refining capacity in 1955 stood at about 244,000 b/d. By comparison, Japanese capacity will have hit 225,507 b/d.

"super" gasoline. Thus, octane ratings are still below the United States levels.

Generally, the products of Germany's refining industry have improved somewhat through the increased use of chemical additives, especially for motor fuels and lubricating oils.

Production of Germany's petroleum processing industry for the past five years falls into the pattern show in Table 2.

Over two-thirds of West German consumption is concentrated on gasoline and diesel oil, while consumption of these light products in other European countries amounts to only 40 to 50%.

On the other hand, Germany's consumption of fuel oils amounts to only 4% of total consumption, while it is relatively high in other countries.

Kerosine is hardly a factor in West Germany, whereas in Great Britain and in the Benelux countries it totals almost 7% of total consumption due to its use in agriculture.

The German petroleum processing industry faces the unpleasant task of getting a high yield of light products from domestic oil which is relatively heavy. This factor explains why German processing trends—thermal and catalytic cracking combined with hydrogenation of residues—play a much greater role in Germany than in other European nations.

Petrochemicals

Germany's petrochemical industry is still in its infancy. The Germans are watching American developments with great interest, but the limitations of domestic oil production, coupled with a shortage of investment capital for new plant capacity, have put a damper on any substantial expansion.

Nonetheless, Chemische Werke Huels—one of three I. G. Farben successor companies—is planning to produce 30,000 tons annually of synthetic rubber based on butane. The necessary butane will, in all probability, be imported from the United States.

Polyethylene will be produced by the newly-founded Rheinische Olefin-Werke in Wesseling. This plant was established jointly by Shell and Badische Anilin- und Soda Fabrik—another I. G. Farben successor company. Farbwerke Hoechst in Frankfurt is also planning to produce polyethylene.

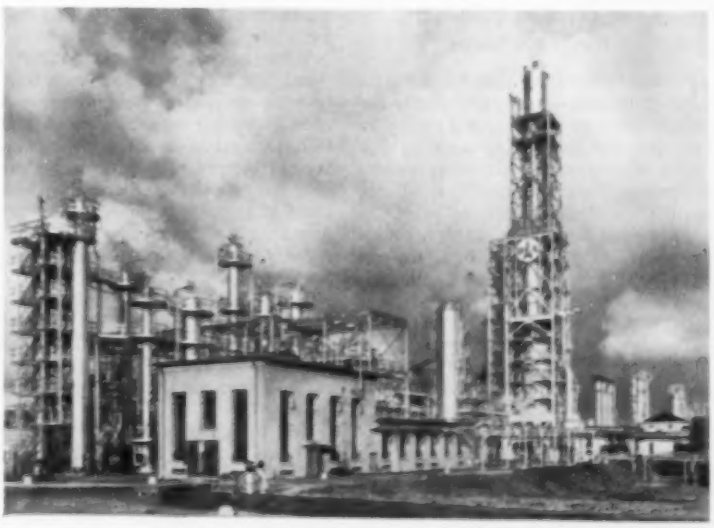
A rundown on existing petrochemical plant activity has been published previously in PETROLEUM PROCESSING. (see the January, 1955, issue, page 12).

FURFURAL extraction plant at Oelwerke Julius Schindler G.m.b.H., Hamburg

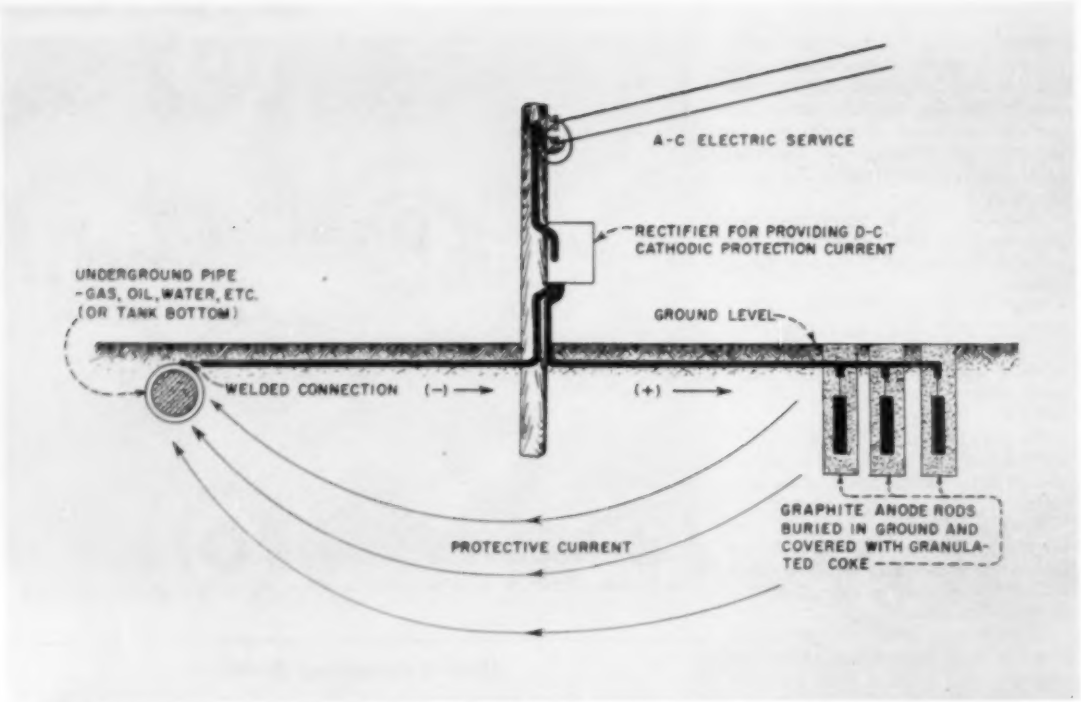
Shell Expanding Further

Shell's West German operations are planning further expansion. The Deutsche Shell-A.G. in Hamburg-Harburg is going to increase its existing refinery capacity to 2,600,000 ton/yr. (about 50,000 b/d), at an estimated cost of 180,000,000 to 200,000,000 German Marks.

Construction plans call for a catalytic cracking unit, a hydrodesulfurization unit, and a second Platformer. Contractors for the catalytic reforming unit are Procon Ltd. of London, and Edeleanu GmbH, of Frankfurt. Shell is negotiating with the city administration of Hamburg for an area of some 370 acres for the plant site. As a result of these plans, it is expected that the city of Hamburg will materialize long-time plans for a second petroleum harbor usable for large ocean-going tankers of all descriptions.



HAMBURG REFINERY of Deutsche Erdoel A.G


A-C ELECTRIC SERVICE
RECTIFIER FOR PROVIDING D-C CATHODIC PROTECTION CURRENT
UNDERGROUND PIPE - GAS, OIL, WATER, ETC. (OR TANK BOTTOM)
GROUND LEVEL
WELDED CONNECTION
(−)
(+)
GRAPHITE ANODE RODS BURIED IN GROUND AND COVERED WITH GRANULATED COKE
PROTECTIVE CURRENT

MAKING ELECTRICITY FIGHT CORROSION—typical circuitry for a rectifier type of cathode system for underground pipe

'Juice' Cheaper than Downtime

Consider cathodic protection for your next problem of underground metal corrosion

By WAYNE A. JOHNSON
Houston, Texas

CORROSION fighting by cathodic protection—used successfully for many years on underground piping by the pipeline companies—can be applied with equally satisfactory results on buried lines and metallic structures in the petroleum processing plant.

A typical installation of such equipment is at the 25,000 b/d, Corpus Christi, Texas, refinery of Southwestern Oil Refining Co. No known corrosion has occurred in the three years the cathodic protection system has been in service on some 47 storage tank bottoms and their interconnecting piping.

Installation cost was less than $20,000. Electric power consumption has been found to be negligible in comparison to the operating cost of the refinery, and only a moderate amount of maintenance has been needed for the electrical system, as it has no moving parts.

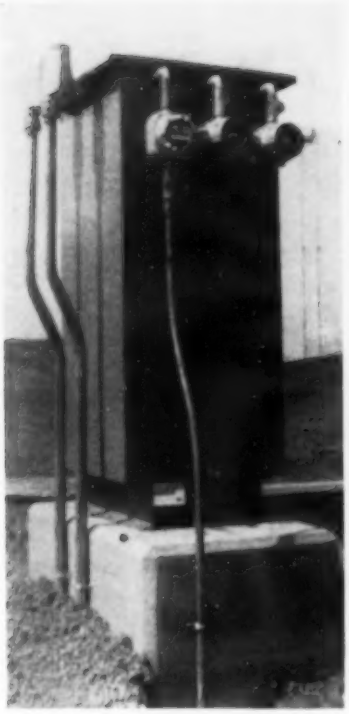
What is cathodic protection? Any metal which is in contact with water or with the soil (which usually contains moisture) may be protected effectively against corrosion by galvanic action (electrolysis) through the application of a slight direct current electrical charge. This charge is usually produced by rectifying the available refinery alternating current supply. See drawing.

Direction of flow of this applied current is from a buried, positively charged anode (or ground) through the soil to the negatively charged cathode (the metallic structure to be protected).

The principle is that the protected structure must be made more electrically negative than the surrounding corrosive medium, be it soil or water. Thus, by applying the direct current voltage and making the protected structure more negative, the corroding currents which would otherwise flow from the metallic structure into the soil are nullified. "Normal" or "static" voltage of the protected structure with respect to the surrounding soil is actually changed. These voltage changes may be measured with a suitable instrument so that the total protective effect can be determined accurately.

Southwestern took its first steps to protect its tank bottoms, and buried oil, water, and gas lines about three years ago. At that time, two rectifiers, each of 100 amp. capacity, were installed at the refinery along with a series of graphite anode grounds which were buried in vertically drilled holes and then covered with granulated metallurgical coke to improve their conductance to the soil.

Rectifying power comes from the available 440-volt, A.C., three-phase refinery power circuit, operating the rectifiers continuously, and discharg-



RECTIFIERS ARE SMALL, take little ground space. This is a selenium plate, oil immersed type, rectifier

ing the direct current into the surrounding tank bottoms and piping.

Three more rectifiers have been added since the first pair because of a refinery expansion and added tanks and lines. At present, a total of about 450 amp. of direct current is providing the desired level of corrosion protection.

The power requirements for the tanks in Southwestern's system are shown in the accompanying table. Total for the tank bottoms comes to 246 amp. The remaining 204 amp. available from the system is distributed around the underground oil, fuel, water, and gas lines. Some of it is "lost" to the reinforcing steel and the old disconnected lines still remaining underground in the operating areas.

Other applications for cathodic protection have been made by Southwestern in addition to the big system on tank bottoms and lines. Magnesium anode rods have been suspended inside two boiler water storage tanks to produce slight direct current charges to the interior walls. The water, although treated chemically, remains somewhat corrosive.

Heat exchanger heads—both the floating head and the channel ends—as well as tube sheets, are being protected by magnesium anodes mounted within the heads. More recently, platinum anodes have been installed on another pair of heat exchangers for cathodic protection. This platinum anode installation offers more flexibility of control, inasmuch as the rectifiers are equipped with control rheostats by which the total amount of applied protective current may be regulated. In addition, the platinum anodes have virtually permanent life.

Power Requirements for Corrosion Protection by Rectifying System

Tank size ft. diam.	Tank capacity bbl.	Amps. req'd per tank	Number of tanks	Total amps.
120	96,000	18	4	72
100	67,000	12	6	72
70	33,000	6	7	42
35	5,000	2	30	60
Total				246

Three important factors must be considered in cathodic protection systems:

1—It must be tailored to fit the facilities it is to protect. Important points in tailoring to fit include the size and layout of structures, the soil conditions, and interference problems with other structures.

2—It is economic when its installation and operating costs are compared with major equipment repairs and downtime due to corrosion. Rectifying systems are considered very attractive economically when they are to be used on a long term basis. Systems are economic also in comparison to safety hazards which might result from corrosion leaks.

3—It is safe if it is properly designed. Arcs or sparks are unlikely if normal precautions are observed and as refinery operating personnel become familiar with the system. Many refineries use 1000 amp. of rectified current for cathodic protection. No fires or other damages are known to have resulted from the use of such systems.

Cathodic protection has come into use during the last ten years as an adjunct to other maintenance and corrosion prevention methods. Although protective coatings may be applied to buried structures, they are frequently not adequate to prevent completely corrosion by electrolysis.

Water storage tank interiors may be painted. However, few paints will remain in good condition over a period of years. Failures of such coatings usually results in corrosion of the exposed metal, especially where the water is of a somewhat aggressive nature.

Corrosion of heat exchanger heads and tube sheets has been quite common. At present, there is no satisfactory paint or coating which will remain in service and continue to protect such equipment.

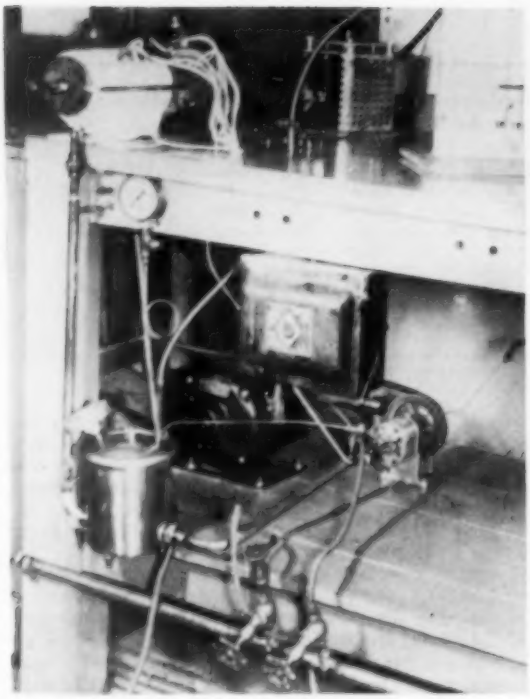
Meet the Author

Mr. Johnson

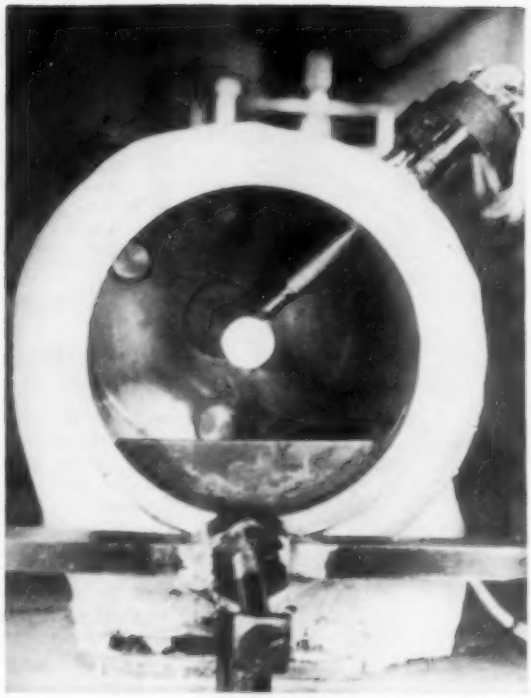
Wayne A. Johnson is president, Corrosion Rectifying Co., Houston, Texas. The firm specializes in designing and constructing rectifying and galvanic anode type cathodic protection for the oil, gas, and construction industries.

Mr. Johnson has been actively engaged in the corrosion profession for many years, having received his early training as a corrosion engineer for The Texas Pipe Line Co. He has written numerous trade journal technical articles on the subject of underground corrosion and the use of rectifying systems.

A graduate of Texas A. & I. College, Kingsville, Texas, during World War II he served in both the Seabees and Navy, seeing two years' overseas service. He is a long time member of the National Association of Corrosion Engineers, the Pipeliners Club, and many other technical organizations.



GOOD CORRELATION WITH FULL-SCALE is claimed for this bench scale apparatus for evaluating aviation lubricants



CLOSE SIMULATION TO FLIGHT CONDITIONS is obtained in the thermo-contact chamber, shown in this close-up

Aviation Lube Tests a Problem?

Here's a bench method aimed at predicting performance under actual flight conditions

By F. G. HESS, F. E. LANDIS, and A. R. RESCORLA
Cities Service Research & Development Co.

PRESENT day bench-scale screening tests for predicting the deposit forming and corrosion characteristics of aviation lubricating oils have many times proved to be inadequate. On several occasions, oils which performed quite satisfactorily in bench equipment decomposed severely under actual flight tests.

As a result, heavy coking and corrosion occurred in engine valve assembly mechanisms and caused failure of these parts. Because of the poor correlation between bench and full-scale performance, new and better laboratory procedures have been a constant goal, so that the qualities of aviation lubes could be pre-evaluated before subjecting them to the more expensive flight tests.

Furthering the need for improved screening tests has been the trend toward the use of additive-type lubricants in aviation, since additive decomposition often occurs at the elevated temperatures encountered in the modern aircraft reciprocating engine.

The test method described here consists essentially of oxidizing an oil at 300° F. and subjecting the oxidized oil—in the form of a fine spray—to temperatures of 550 to 900° F. Corrosiveness of bronze test pieces was determined in both the liquid and the vapor phase. Carbon formation was measured by weighing the deposit formed on the heated surface. Changes in the properties of the oils were determined from the materials analyses which consisted of naphtha insolubes, neutralization number, and viscosity.

Test results were favorable to the method. They showed it is possible to differentiate between an unstable oil with corrosive tendencies and a stable oil which is not corrosive. Two of the oils were additive type and were field tested in regularly scheduled transport planes. These tests showed qualitative correlation with the bench-scale performance, indicating that the laboratory methods might be used to predict aviation lube oil performance with respect to valve stem deposits and corrosion.

Laboratory Equipment

The two photographs above show the testing apparatus and a close-up view of the contact chamber. Essentially, the apparatus consists of a high pressure oil pump driven by a ½ hp.

electric motor, a spray nozzle enclosed in a chamber of one liter capacity, and an oil sump. The chamber is heated externally by means of resistance wire, and is insulated. With equipment of this particular design, the high temperature-pressure decomposition of additive oils can be studied under conditions closely simulating those found in a typical aircraft engine at normal temperatures.

In the close-up picture of the chamber will be seen a steel tube. This tube has installed within it a heater so wound as to produce a temperature gradient of 550-900° F. along its length. The tube was so designed as to simulate the temperature conditions around the valve stem areas of full-scale engines as closely as possible.

By means of five thermocouples inserted in the chamber, the temperature of the tube at various locations can be measured, and a determination of the temperature at which decomposition occurs can be made. An oil level is maintained in the chamber by means of a weir at the end near the outlet. The bench testing equipment just described is made entirely of stainless steel.

Operating procedure follows: A previously weighed tube is mounted in the chamber and its heater inserted. One weighed bronze test specimen (an actual aircraft engine valve keeper) is placed in the bottom of the chamber where it is immersed in the oil under test while a similar specimen is hung in the vapor space just below the level of the tube in order to quantitatively determine the amount of bronze corrosion occurring in both the liquid and vapor phases. 1500 ml. of the oil to be tested are charged to the sump and a polished copper strip is immersed in it.

The oil in the sump is then heated by means of an immersion heater to 250° F. and the body of the chamber is heated to 400-550° F. at the same time. Water is turned on in the condensing system leading to the pump in order to maintain constant temperatures throughout the system. Circulation of the oil is started. The tube heaters are turned on and the temperature of the tube is regulated by means of transformers to maintain a gradient temperature of 550-900° F. along the axis of the tube.

The oil in the sump is then adjusted and maintained at 300° F. for the duration of the test. At this point air is introduced into the sump through a gas dispersion tube at the rate of 10 liters/hr., the air being measured by a calibrated flow meter.

Circulation is continued under the conditions just described with the oil pressure kept at 400-500 psi for 24 hr. Temperature and pressure readings are recorded every 30 minutes and samples for viscosity at 100° F. and neutralization number obtained every six hours.

After 24 hr. running time, the test is shut down for examination. This is done by turning off all heaters and circulating the oil with cooling water in the condensers until the body of the chamber reaches a temperature of 300° F. and the oil in the sump drops to 200° F.

Circulation of the oil is stopped and the tube and test specimens are removed and washed thoroughly with ASTM precipitation naphtha. After weighing the center rod test specimen

Why and How the Method Was Developed

AS a direct result of the existing inadequacy of available laboratory screening tests for aviation lube oils, the Coordinating Research Council in the fall of 1950 initiated a program design to develop better techniques for pre-evaluating lubricants which would afford a better understanding of the requirements and performance characteristics of petroleum products and engine equipment.

This program was coordinated with an extensive flight test survey on full-scale aircraft. A series of specific performance criteria were scheduled for study—including spark plug fouling, preignition, bronze corrosion, wear, and engine cleanliness as well as rocker box coking. Leading petroleum companies, additive suppliers, and aircraft organizations were invited to participate.

One direct result of the survey was the presentation of a large number and variety of bench-scale tests, each with the specific purpose of giving an improved technique for screening oils prior to actual flight testing.

The accompanying article presents a test procedure developed in the Cities Service Research & Development Co. laboratories. It was designed primarily to study valve stem deposition and corrosion of engine parts due to oil decomposition at elevated temperatures. The scope of the method has not been extended to an actual quantitative comparison of bench-scale with flight engine deposition and corrosion tendencies. It does, however, attempt to illustrate a qualitative method for differentiating between an oil which decomposes readily at elevated temperatures and one which is relatively stable to thermal decomposition.

Table 1—High Temperature Deposition and Corrosion Properties of Aviation Lubricating Oils

Sample Number:	A	B	C	D
Description:	**Base Oil with Additive "A"**	**Base Oil MIL-L-6082A Type 1**	**MIL-L-6082A Type 2**	**Base Oil with Additive "D"**
Weight of Deposit, grams:				
Center Rod, 6 hours	0.1090*	———	———	———
Center Rod, 24 hours	———	0.3136	0.1480	———
Center Rod, 36 hours	———	0.4581	0.3441	0.2290
Corrosion Test Piece 1 (Liquid)	+0.0527	−0.0047	−0.0011	−0.0005
Corrosion Test Piece 2 (Vapor)	+0.1235	−0.0024	−0.0067	−0.0035
Neutralization Number, mg. KOH gm:				
Original	0.06	0.05	0.04	0.03
6 hours	0.62	———	———	———
36 hours	———	0.41	0.65	0.63
Viscosity at 100° F., SUS:				
Original	1139	1238	1294	1216
6 hours	1072	———	———	———
36 hours	———	1033	1277	1177
Ash, %:				
Original	0.0300	0.0014	0.0017	0.0029
Final	0.0070	0.0031	0.0026	0.0038
Naptha Insolubles, %:				
Original	0.070	0.050	0.028	0.044
Final	0.145	0.140	0.085	0.081
Corrosion, (Copper):				
At 212°F	None	None	None	None
At 300°F	Heavy	None	None	None

*Test discontinued after 6 hours due to heavy deposition.

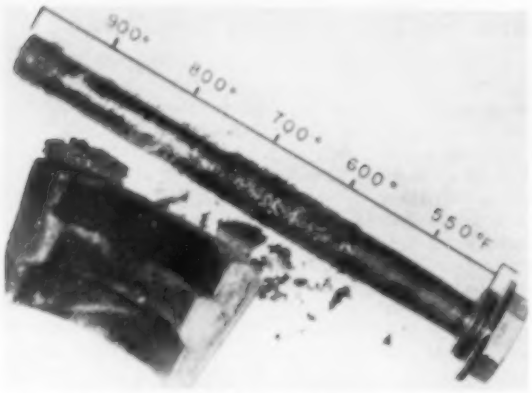


FIG. 1—Temperature effects on deposition and corrosion for Sample A

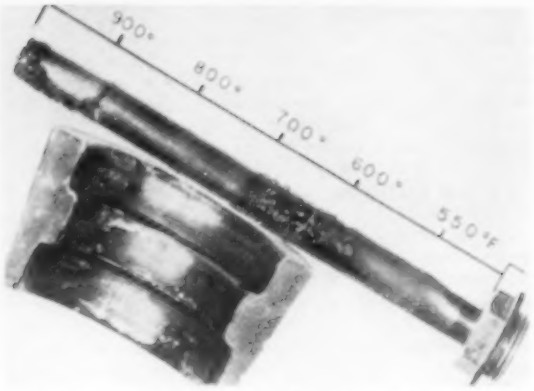


FIG. 2—Temperature effects on deposition and corrosion for Sample D

and the two bronze samples, the parts are returned to the chamber and the test is started again as described previously.

After 36 hr. operating time it is again shut down as before, oil is drained from the system and the tube and test specimens washed and reweighed. The copper strip is also removed from the sump, washed and observed for evidence of corrosion.

The following tests were made on the oil samples at the start and at the finish of the run; neutralization number, viscosity at 100° F., percentage ash, and the percentage of naphtha insolubles.

Laboratory Evaluation

In order to evaluate the bench-scale equipment just described, a series of aviation lubricating oils were analyzed for deposition-corrosion characteristics. This series included a number of commercial oils conforming to existing aircraft lubricant specifications as well as some experimental blends with and without the incorporation of additives.

Corrosion-deposition and oil inspection data for four typical oils are presented in Table 1. Two of these oils, *A* and *D*, are additive type lubricants while B and C are Federal Specification (MIL-L-6082A) oils which contain no additives other than pour point depressants.

It is interesting to observe from the table that the oil inspection data; i. e., neutralization number, viscosity, percentage ash, and percentage naphtha insolubles for all four oils, were practically the same and that changes in these properties from start to finish of the test run were not sufficiently great to give a true record of oil decomposition and the resultant corrosion-deposition.

However, corrosion and coking data for all four oils did show significant differences. Sample *A*, in particular, coked so badly after only six hours running time that the test had to be discontinued due to clogging of the oil lines. Laboratory analysis of the flake taken from the center rod test specimen showed it to contain a large percentage of phosphorus and elemental sulfur which definitely confirmed that additive decomposition was actually occurring.

Oils *B*, *C*, and *D*, in contrast, gave considerably less deposition and endured the complete 36-hr. test cycle. Sample *A* gave heavy positive bronze corrosions in both liquid and vapor media and showed heavy corrosion to copper at 300° F. while *B*, *C*, and *D* gave very light negative corrosions to bronze and were noncorrosive to copper.

To better illustrate the phenomena of valve stem deposition and corrosion which occurs with the test apparatus just described, a series of photographs is included here. Fig. 1 shows a tube and a vapor phase corrosion specimen taken from the test using oil *A* after 6 hr. running. It will be observed that heavy coking is evident over the entire length of the tube from the 600 to the 900° F. gradients indicating that oil decomposition occurred throughout the entire temperature range. Coking in this sample was

FIG. 3—Valve keeper after flight test using Sample A

Table 2—Oil Inspection Data—Full Scale Tests

	Sample A			Sample D		
	Base Oil	with Additive "A"		Base Oil	with Additive "D"	
Time Since Drain, hrs.	54:02	138:34	232:17[1]	128:23	125:04	478:01
Analysis,						
Ash %	0.51	——	0.75	0.37	0.30	0.36
Carbon Residue, %	1.3	2.0	1.9	——	——	——
Copper Strip Corrosion	None	None	None	——	——	——
Crankcase Dilution, %	None	None	None	None	None	None
Flash Point °F	——	510	495	515	530	520
Fire Point °F	——	575	575	580	580	605
Neut. Number, mg. KOH/gm	0.6	0.5	0.38	0.61	0.50	0.59
Pentane Insolubles, %	0.92	1.54	1.54	1.4	1.8	1.3
Viscosity:						
At 100°F, SUS	1192	1226	1234	1200	1262	1309
At 210°F, SUS	97.6	100.7	100.7	101.7	107	107.2
Water, %	1.1	None	——	Trace	Trace	Trace

[1]Engine failed and removed from service.

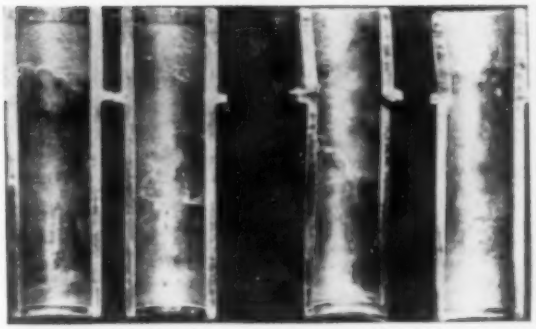


FIG. 4—Valve stem guides after flight test with Sample A

FIG. 5—Rocker arm deposits after flight test with Sample A

so heavy that flaking of the deposit was evidenced. It is interesting to note the spongy-like appearance of the bronze valve keeper shown in this photograph.

Fig. 2 is a photograph of an assembly taken from a 36-hr. run using the same base oil as used in sample *A* but with the incorporation of a different additive. In comparing Fig. 2 with Fig. 1, it is quite apparent that the degree of deposition in case *D* after 36 hr. running was much less than that of oil *A* after only 6 hr. Similarly the corrosion specimen taken from the test using oil *D* was in much better condition than the one from oil A.

A careful examination of the results compiled in Table 1 and a comparison of the photographs in Figs. 1 and 2 would tend to indicate that the bench-scale method does at least show a qualitative differentiation between the thermal decomposition characteristics of various oils.

Flight Test Results

Prior to testing in the bench equipment, both oils *A* and *D* were used in a full-scale commercial aircraft engine under standard operating conditions.

In this study, as in the scale testing, periodic checks of the crankcase oil for neutralization number, viscosity, naphtha insolubles and percentage ash were made. Qualitative inspection of rocker arm boxes and valve assemblies were made at the beginning and end of the test period.

Table 2 gives oil inspection data for both oils at designated time intervals. A study of the data presented in this table reveals that used oil inspection gave no true criteria for predicting additive oil decomposition, yet oil *A* withstood only 232 hr. of actual operation before it had to be removed from service due to heavy sludge formation and consequential engine failure, while oil *D* after 500 hr. of use still gave good engine performance.

Fig. 3 illustrates a valve keeper removed from the engine using oil *A* after failure. The heavy pitting and corrosion which had taken place is readily seen and is comparable with that obtained from the small-scale apparatus.

The valve guides removed from this engine were divided in half and the sectional views contained in Fig. 4 give further confirmation of the degree of corrosion and erosion which had taken place.

As mentioned previously, in the operation of the modern aircraft engine, the exhaust valves are subjected to very high temperatures—often approaching 900° F. The crankcase oil comes into contact with these valves through the rocker arm box where the valve assembly is lubricated.

Relatively unstable oils have a tendency to coke at these high operating temperatures and produce deposits which form in the rocker arm box and on the valve assemblies and prevent proper valve functioning. Fig. 5 shows a rocker arm box assembly taken from the engine where oil *A* was used as the lubricant. The heavy sludge formation is readily apparent.

In contrast, Fig. 6 shows the valve guides taken from the test using oil *D* which operated for 500 hr. before overhaul. Here corrosion was very light and the guides were in much better condition than those removed from the engine using additive oil *A*. Inspection of the rocker arm boxes from the flight tests using lubricant *D* indicated a very clean condition as will be observed from Fig. 7

Acknowledgement

The assistance of Mr. P. B. Levitt in designing and constructing the equipment employed in this investigation is acknowledged. The authors are also grateful to Cities Service Research and Development Co. for granting permission to publish this paper.

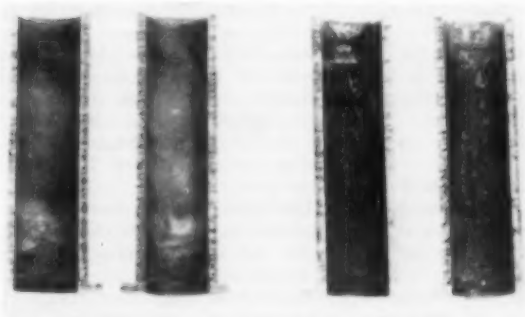


FIG. 6—Valve stem guides after flight test with Sample D

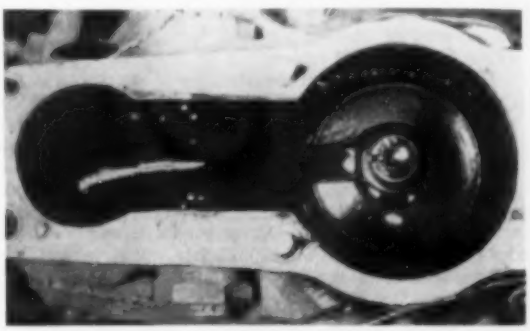


FIG. 7—Rocker arm deposits after flight test with Sample D

AFTERMATH OF A HURRICANE—left to right: process areas devastated, power lines down and out . . .

It's Hurricane Time Again

Are you prepared for an emergency? Here's a plant disaster plan that works for Dow

By D. P. THORNTON, Jr.
Southwestern Editor

IN the next week or two you can expect more than a few rough hurricanes, heavy gales, and violent storms to hit the United States in several refining and petrochemical processing areas. In fact, by the time you are reading this, the fall storm season will be at its height.

Is your plant prepared to ride out such storms? Even if you're not in the usual storm areas, nature occasionally has a way of striking with all her might in unexpected regions.

Here's a workable procedure Dow Chemical Co. has set up for its Freeport and Velasco, Texas, operations. It's a tried and proved plan that has met the test of actual hurricanes in the heart of one of this country's high-wind areas.

And it's a plan that would work in the event of war-time attack, officials believe, provided there is adequate warning through Civil Defense organization alerts.

The key is Dow's aim for the system: "Shut down and evacuate in nothing flat." And the company has been ducking hurricanes, or preparing to duck, for the past 14 years, considering this a normal business hazard. In that time, the company has been able to develop a scheme to hit the target it is shooting at.

The five salient features of Dow's emergency evacuation procedure are:

1—Development and constant revision of an emergency evacuation (with recall) plan which involves everybody from top management to yard hand.

2—Close liason with local law enforcement authorities as well as with Red Cross and other agencies for protection of life and property.

3—Installation of its own storm-warning, radar equipment.

4—Cooperative effort with U. S. Weather Bureau and other industrial organizations similarly situated to improve accuracy of forecasting and detecting storms.

5—Measures to keep employe morale high in event of emergency evacuation and storm conditions.

Planning arrangements at Dow work under a number of sub-committees, each reporting to one general committee. These committees revise the plan as it is used each year and make all preliminary arrangements. Committee members direct the actual shutdown and evacuation, as well as the clean-up afterwards to return the plant to full operation. Top management has the sole responsibility to order the shutdown.

Here's how the 1955 plan is set up. Nine sub-committees work under the direction of a General Hurricane Committee. The general committee consists of the sub-committee chairmen (with vice chairmen as alternates), and a general chairman who also is the general superintendent of industrial security for Dow's Texas Division.

Hurricane Warning: Revise and reestablish the system for obtaining accurate and timely reports concerning origin, intensity, and movement of tropical disturbances. Issue regular reports on them to management.

Plant Operations: Prepare plans and

. . . and barges and docks a shambles.

establish procedures for shutdown in event of hurricanes and for resuming operations afterwards, including procedure for disseminating shutdown and start-up operations orders. Schedule reassignment of motor transportation and radio equipment during shutdown.

Establish the maximum number of employes, by departments, required to work during the shutdown. Select the employes and alternates from those people with no dependents or who will be able to evacuate dependents without company assistance. Include indication of method whereby these emergency crew members may be contacted on short notice during the hurricane season.

Evacuation and Transportation: Arrange with public carriers for sufficient and adequate transportation in the event evacuation of employes becomes necessary. Arrange with municipal, county, and state authorities for necessary policing of traffic, and the Brazoria County Disaster Relief Committee, American Red Cross, for coordination between that organization and this committee.

Supplies and Communication Facilities: Arrange in advance for food, food preparation, and sleeping accommodations for employes required in the plants during a shutdown. Determine needs and provide company radio and telephone communications facilities as required.

Hospital: Arrange for safe operation of company hospital during the hurricane shutdown.

First Aid: Set up and man first aid stations at points within the plants where personnel will be located during shutdown.

Safety: Make necessary arrangements for employes' safety during shutdown.

Employe Information and Property Protection: Provide general protection for plant facilities and employes. Disseminate on an area-wide basis advice on hurricanes and management information to employes, including telephone bulletins via Magnecorder. Contract with commercial radio stations in the area for employe notification. Establish outlying contact points to advise employes when to return to work after evacuation.

Preparation, Repair, and Clean-Up: Prepare buildings and yards for the hurricane season in keeping with established standards. Conduct occasional inspection surveys and police plants and ground constantly during the hurricane season. Install storm shutters as designated by management in the event of evacuation. Close doors and windows in plant buildings not equipped with shutters, and close all levee openings. Police and make repairs as necessary and possible during the actual hurricane shutdown, completing the procedure after the hurricane.

Prepare hurricane damage estimates for insurance claims. Gather data and submit report to management on tide levels before, during, and after a hurricane.

These subcommittees and the general committee are responsible for the smooth operation of the plant shutdown and evacuation system, which consists of general requirements plus detailed shut down procedures for each individual unit in the plant.

Only four operating units out of 40 to 45 in the two plants at Freeport and Velasco continue in operation regardless of hurricane. These are the producers of utilities—power, steam, gas, and water.

All told, approximately 240 men stay in the two plants during a hurricane, less than 5% of the total payroll. They represent practically all departments and many operating units. The largest groups of personnel are posted at the hospital (60, excluding patients), power plants (37), the electric shops (23) and plant protection (22). A crew of 23 men is divided between the magnesium cells in the two plants. A relative handful remain in other facilities.

Considering Dow's two plants as an entity, 10 to 15 units can shut down in an orderly fashion, with due regard to safety and protecting equipment from damage in the shutdown, in five hours or less. Between 25 and 30 units require from five to ten hours for orderly shutdown. Three require from 10 to 20 hours. Manpowerwise, the first group of 10 to 15 units represents 48% of the manpower on duty during daylight hours in the two plants; the second group of 25 to 30 represents 47%.

This means that 95% of personnel can be out of the plants within 20 hours of a shutdown order.

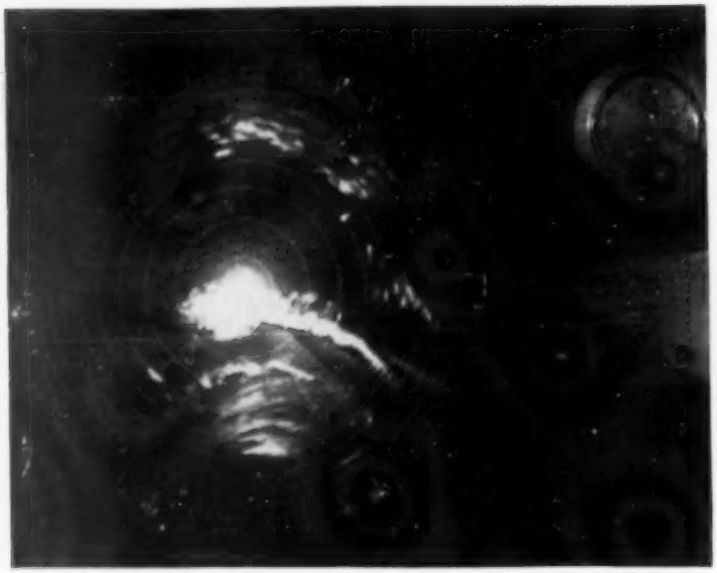
However, this also means the turning of a very large number of vehicles loose on the highways feeding the plants and could result in a king-sized traffic snarl as personnel rushed to their homes, gathered up their families, and again took to the highways away from danger.

Hence it is necessary for Dow to enlist the help and cooperation of local law enforcement agencies plus its own plant police to move this flood of vehicles out of its plants, to their homes and away again, with due regard to the rights and privileges of non-Dow residents of the area just as anxious to get clear of potential danger.

Warning and Evacuation Procedure

Dow has several avenues open to receive hurricane warnings which operate from June 15 to November 1, the normal hurricane season. Ever since 1942 it has had nine stations cooperatively manned by other interested industries and extending from Brownsville, Texas, east to New Orleans.

These stations are equipped (at



RADAR—A KEY TO DISASTER PLANNING. Screen shows "eye" of a rugged hurricane Dow experienced Oct. 3, 1949

Dow's expense) with recording barometers. These instruments are read on a set schedule and reported to Freeport. Mutual storm information is passed back and forth at these times, and at any time if the situation warrants.

A high-powered radar scanning installation is located in an air-conditioned cubicle in one of Dow's Plant "A" powerhouses at Freeport. It went into operation in 1948. Built from war surplus equipment and based on military findings that the water content in heavy storms would produce a radar trace, the installation has since been repeatedly improved. The "big" radar unit has a 300-mile range and can "see" the Mexican coast line below Brownsville. This radar follows not only the center of a disturbance but can also be used to view a vertical "profile" of a hurricane or rainstorm.

In the only storm which has hit Freeport since the radar was installed, the spiral nature of the storm is clearly evident in photographs while the center still was nearly at extreme range.

All during the hurricane season the radar is manned once daily in a thorough search at extreme range and observations are passed on to the U.S. Weather Bureau. Once in a while, its aid also is enlisted to locate craft which are lost without navigation equipment in thick fog and guide them into Freeport Harbor. When a "suspicious area" is noted, the unit is manned more frequently until it comes within the 300 mile range and preparations are made to sound the first alert. The 'scopes thereafter are continuously manned until the danger is over or the storm takes off in one of the characteristically unpredictable antics of these disturbances and decides to go elsewhere.

The third line of warning is a direct teletype connection with the Houston Weather Bureau, maintained so Dow can periodically report its radar findings, and also to facilitate a cooperative research program with the Bureau.

All information from Dow's radar is sent directly and exclusively to the U.S. Weather Bureau where it is used along with other data to make up the Weather Bureau's storm warning advisories which are available to the general public. At the Bureau's request, Dow also transmits data from its nine coastal observation points.

In return, Dow receives by teletype the same weather advisories the Bureau customarily reports for public distribution. (The Bureau has similar arrangements with other industrial organizations as well. Dow is not the only one tied into its teletype net. —Ed.)

Dow's employes are even more interested in the weather than are most citizens, for many well-know the destructive power of a hurricane; besides, a lot want weather data for fishing and the like. Originally installed to disseminate hurricane information and related management instruction to employees, a magnetic tape recorder was permanently connected into Dow's plant phone system. Dialed like any other plant number, it gives the listener the latest available weather forecast throughout the year. With a hurricane in the offing, this arrangement materially lessens the flood of inquiries to the plant security office, headquarters for weather data.

A dual-warning system is used to provide adequate protection to personnel and equipment at the Dow plants.

The first warning is a "preliminary alert" and is sounded as soon as winds of dangerous velocity come within 200 miles of the Freeport area. It is preceded by daily bulletins, posted throughout the plants, whenever a possible hurricane is detected either in the Gulf or Atlantic Ocean; two bulletins are posted daily when the disturbance comes within 500 miles of Freeport; as many as practicable when a storm is within the 200-mile circle.

The alert goes out when the high winds circling the edge of the hurricane proper come within the 200 mile limit. Since the storm may have from a 50-mile diameter or less up to more than 100 miles in radius, there is no assurance at this time what its final path will be. Also, as these storms usually travel from 10 to 15 mph the usual time lapse to "come in" will exceed 24 hours because the storms rarely move in a straight line and may stop entirely for a considerable time or even reverse course.

When the preliminary alert is sounded, all units which require more than six to seven hours to shut down safely and efficiently are immediately started down. Some production units in other plants which can go down within this time, but whose outage will not curtail end-product production, also start down.

All preliminary and protective work is commenced when the preliminary alert is issued. This includes tying down material and equipment where necessary, checking storm pumps, putting up storm shutters, closing levees and the like. Plant yards are never allowed to become "cluttered", however. This is because it is foreseeable that a final alert might be called at any time.

Instructions also are given during this alert as to which individuals are to remain in the plant and their stations, and to others as to contact points to receive back-to-work orders. Key personnel who will be needed first after the danger is past make special arrangements for early contacting.

During this time also, all mainte-

nance work which requires a unit shut-down is listed with the maintenance department so that much of this work can be scheduled before resuming operations. Maintenance personnel usually are the first group to return after an evacuation, to repair probable plant damage and perform this turnaround work.

The final warning, including a general shutdown order, is issued 10 hours ahead of the time when it is estimated that winds of dangerous velocity will hit Freeport. All units still operating shut down in coordination with inter-related units as rapidly as is safe for personnel and equipment. This allows two hours for the last employees to leave the plant to be safely enroute to their destinations outside the Freeport area before the leading edge of the storm hits.

Detailed shut down procedures are issued to each individual unit in the plants *before* the beginning of the hurricane season. Since these would in general apply only to Dow's units, they will not be discussed here. However, they are "streamlined" versions of the normal shut down procedure for each particular unit with provisions to avoid upsetting associated units either supplying or being supplied with feedstocks. A reverse sequence is used to resume operations and may be modified by the Operating Board. Individual unit plans generally are prepared by their top supervisors.

After personnel leave, there are five contact points in the cities of Houston, Columbus, Rosenberg, Bellville and Brenham where employees may notify the company where they may be reached for return-to-work instructions. Families of employees also may notify these points of their location should members become separated in the evacuation.

Four radio stations in Houston and one each in five other cities as far away as Dallas are under contract with Dow to issue instructions to employees and advise conditions at Freeport during and after the storm. They also broadcast return-to-work instructions. The latter is particularly important, as some routes returning employees might elect to use may be blocked by storm waters or other obstacles.

When the storm is over, a clean-up crew is sent out from the pool of men remaining in the plants for a quick survey as soon as it is safe to venture outside. The first actual job is to sufficiently clean those streets needed for access to emergency buildings, such as the hospital and first aid points. Only general plants are available for resuming operations, since fairly detailed damage surveys are needed to ascertain repairs necessary before units can be again brought into operation. Utilities are restored as quickly as possible and units which are needed first receive priority in damage-repair attention. The latter details await the orderly return of the more responsible executives.

RADAR ANTENNA IS RIGHT IN THE PLANT, atop a tower in a glass fiber-plastic dome at Dow's Gulf Coast facilities

Community Assistance

Although not a part of its legal responsibility, Dow takes a strong and laudable stand in its moral responsibility to assist the communities where its employees reside in the event of a hurricane or other disaster.

The head of Dow's General Hurricane Committee is chairman of the Brazoria Red Cross' Disaster Preparedness Relief Committee, formed in 1946, to which thirteen major subcommittees report plus the several community disaster committee representatives scattered throughout the county.

Dow uses the same points to post its bulletins as selected by the Red Cross to disseminate warning information to the general public. These are made available by numerous cooperating organizations, including local stores, service stations and the like. The Dow hospital at Plant "B" in Velasco is one of the Red Cross first aid stations, and so is one of its Plant "B" warehouses. Also listed in the Red Cross booklet on disaster preparedness are Dow's three-way radio facilities.

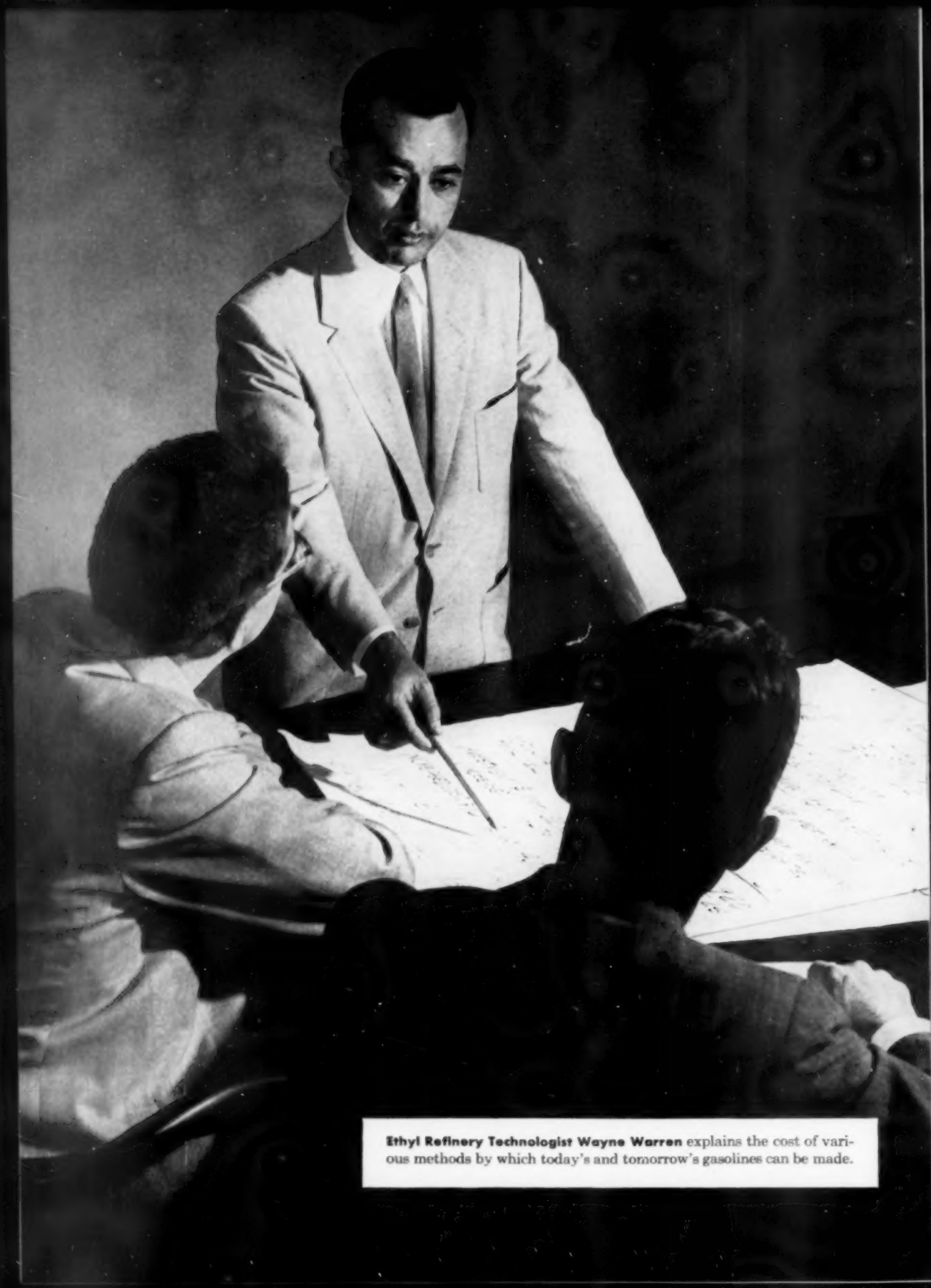
Why the Plan Was Developed

The principal reason Dow has expended so much time and effort on combatting the effects of possible hurricanes is the location of its facilities —for the most part within five miles of the open Gulf of Mexico and on land averaging less than 10 ft. above mean high tide.

Therefore, its plants are designed to withstand the violent winds and rains which come with hurricanes. In addition, the threat of storm tides is met by the levee system built to protect both the plants and the nearby communities. Even so, it is economically unfeasible to design plants and a levee system which could stand up against any conceivable hurricane possibility; hence, Dow's shutdown and evacuation planning.

In its 14-year experience in the area, Dow's plants have been under hurricane alerts and employees' nerves have been jangled more or less severely about 70 times. There have been five emergency shutdowns ordered in this period, but the storms actually hit the plants only three times.

The evacuation plan has been developed from experience and trial-and-error. Each year now as the hurricane season nears, the previous year's plan is brought out for rexamamination and revision where needed. In the event a hurricane does hit, a critique is held afterwards to spot inadequacies. The 1955 plan is in effect as this is written, even though no shutdowns have been necessary since 1949.



Ethyl Refinery Technologist Wayne Warren explains the cost of various methods by which today's and tomorrow's gasolines can be made.

Incremental cost is the key to analyzing the economics of your top octanes. Here are typical cost figures for today's U.S. premium grades.

In each refinery the cost of top octanes depends on many variables...and that's another reason why Ethyl's experienced people can be helpful to you when you make your cost analysis.

Ethyl Research analyzes lowest-cost routes to top octanes

At today's octane levels, each small improvement in gasoline quality becomes increasingly expensive.

Can anything be done about it?

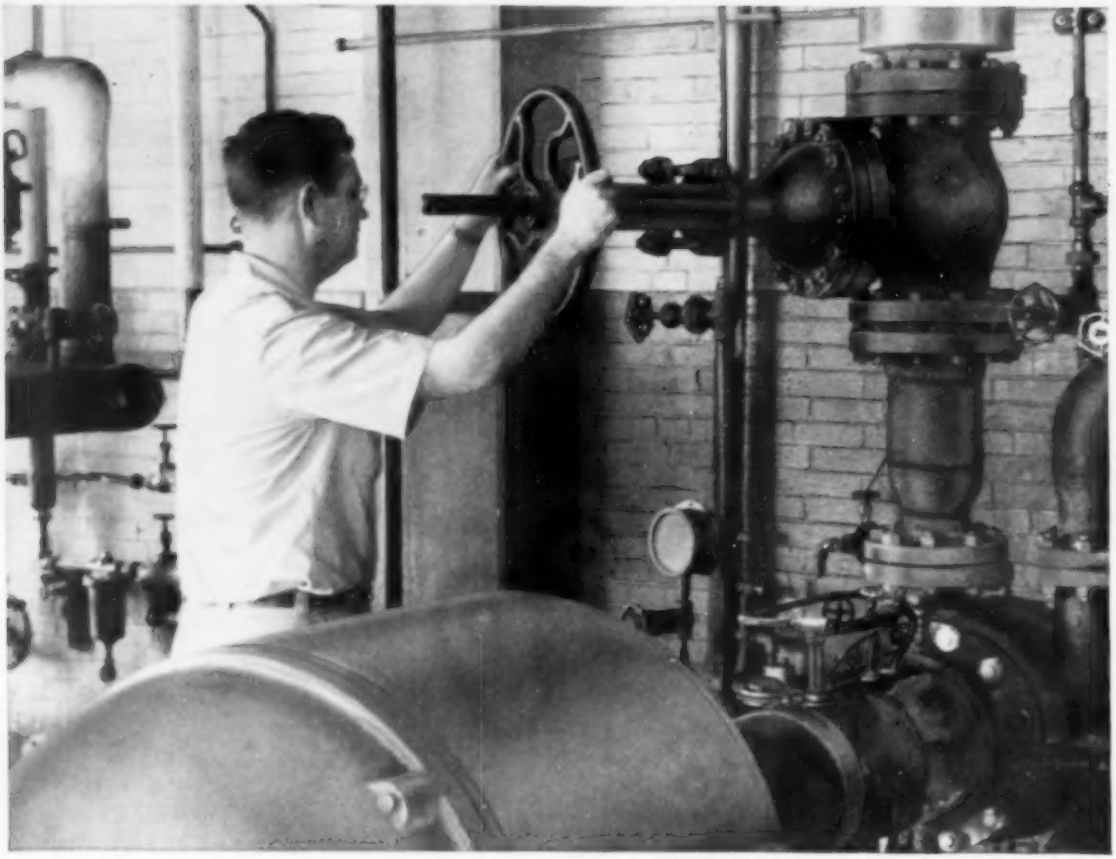
Ethyl Refinery Technologists have developed analysis techniques which may help define and thus minimize these costs. Key to analysis is the study of *incremental* costs . . . or the rates at which costs increase as you raise the octane number. (Handily expressed in cents per research octane number per barrel—¢/RONB.)

In your own refinery, an analysis of incremental costs may show that you can most profitably gain your top octanes by one of several processing alternatives. Or it may show that the cheapest route is to add lead up to the full 3 cc. Such a study can be very rewarding.

Our Refinery Technology staff is available to help you initiate and check your own analysis. Or if you prefer, we are equipped to do a complete economic analysis for you.

For more information, call your Ethyl Representative. He'll be glad to arrange an appointment for you with one of our Refinery Technologists.

ETHYL CORPORATION
Research Laboratories
1600 West Eight Mile Road, Ferndale 20, Michigan
2600 Cajon Road, San Bernardino, California



11 years on hot oil . . . this Crane valve works like new

THE CASE HISTORY—Prolonged service on oil at 750 deg. F. is a tough test for any valve. When a valve takes it for 11 years, 24 hours a day, 7 days a week—and remains fit for more—that's performance worth noting.

Continental Oil Company's refinery at Ponca City installed this 6-inch, 300-pound Crane steel gate in 1944. It's on the suction line to the pump for tar stripper bottoms—the original location. It is operated about once a month.

Except for two down time periods each year for routine inspection, this No. 33X Crane valve has given continuous service. It shows no effects from the prolonged high temperature; it operates smoothly, easily, and remains absolutely tight at the seats. It looks good for service indefinitely.

Some refinery valve buyers believe that all 300-pound cast steel gate valves are alike. That just "ain't so." Crane, through proper design, careful heat-treating, and accurate finishing, produces seating of Exelloy that is, with other quality features, giving outstanding performance on hot oil in plant after plant. When you specify or buy valves for this service, remember there is no "equal" to Crane.

In steel valves as in other materials, Crane gives you complete selection: gates, globes, angles, checks, and stop-checks—screwed, flanged, or welding ends—sizes up to 24 in.—pressure classes up to 2500 psi. Your Crane Representative can give valuable help in specifying and ordering. Crane Co., General Offices, Chicago 5, Illinois. Branches and Wholesalers in all industrial areas.

CRANE CO.

VALVES · FITTINGS · PIPE
KITCHENS · PLUMBING · HEATING

CRANE'S FIRST CENTURY...1855-1955

Petroleum Processing

SEPTEMBER 1955

Petrochemical Section

IN THIS SECTION

Petrochemicals
—1955 Report

42 pages of Up-to-date Information

- **Economics of the Industry** — the picture today, the outlook for tomorrow . . p. 1387
- **As for Specific Petrochemicals**— these are the ones to keep an eye on . . . p. 1390
- **Selecting Equipment for the Plants:**
  - —to resist corrosion . . . . . p. 1393
  - —for gas purification units . . . . . p. 1396
  - —in sulfur recovery service . . . . . p. 1400
- **New Equipment and Materials**
  —over 50 reviews of recent developments, selected for their possible application in petrochemical plants . . . p. 1404
- **Who's in Petrochemicals** —where they are, what they make—4th annual directory . . . . . p. 1413
- **New this Year** — an alphabetical product listing, indexed to the plants that make them . . . . . p. 1427

In the Departments

Are you plagued by storage tank water drawoffs that freeze during sub-zero weather? Here's how one plant has licked the problem—(Plant Practices) p. 1429

"Whosoever shall compel thee to go a mile, go with him two." Are you traveling your "second mile"? —(Editorials) p. 1504

OTHER DEPARTMENTS

Lab Practices 1485
New Words 1429
Personals 1441
Patents 1445
Suppliers 1455
Meetings 1461
Books 1465
Information Offered 1470
Advertisers' Index 1472
What's New 1473

Fuelguard
PREVENTS SLUDGE IN FUEL OILS . . .
FROM REFINERY TO BURNER
Prevent sludge in cracked fuel oils and in blends containing cracked stocks—during refinery storage, distribution, and right to the oil burner—with Fuelguard, the new, ashless fuel oil additive.
Economical Fuelguard treatment stops filter plugging and burner clogging to greatly reduce servicing required. In diesel fuels, Fuelguard prevents injector sticking without causing exhaust sparking.
Send for the new, Fuelguard brochure and a laboratory sample of Fuelguard.
Carlisle Chemical Works, Inc.
Reading, Ohio

PETROCHEMICAL'S GROWING ROLE IN THE CHEMICAL WORLD*

	OUTPUT, billions of pounds					VALUE, billions of dollars				
	1953	1954	% Chg. '53-'54	1955	% Chg. '54-'55	1953	1954	% Chg.	1955	% Chg.
ALIPHATICS	16.2	15.8	− 2.4	19.0	+20.3	2.74	2.33	−14.9	2.76	+18.3
AROMATICS	2.2	3.0	+36.3	3.2	+ 6.6	0.28	0.52	+85.5	0.54	+ 3.8
INORGANICS	6.9	7.7	+11.6	8.8	+14.3	0.20	0.32	+60.0	0.35	+ 9.4
TOTAL PETROS.	25.3	36.3	+ 4.7	31.0	+17.0	3.22	3.17	− 1.5	3.65	+15.2
ALL CHEMICALS	114.3	114.6	+ 2.6	127.0	+10.8	6.10	6.04	− 1.0	6.75	+11.7
PETROS. AS % OF ALL CHEMICALS	22%	23%	+ 4.5%	24.4%	+ 6.1%	52.7%	52.5%	− 0.4%	54.0%	+ 2.9%

*Product and value data are by Dr. R. L. Bateman, Director of Product Development, Carbide and Carbon Chemicals Co.

For Petrochemicals—

Things Are Picking Up

By V. B. GUTHRIE
Associate Editor

The editors of *Petroleum Processing* have just completed their annual mid-year study of the Petrochemical Industry—where it is and where it's going. Here are the highlights:

- **The immediate outlook is for over-all output in 1955 to climb about 17%, after only a moderate gain last year. Total production may reach 31 billion lbs. and may expand to 35 billion in 1956.**
- **During the next five years petrochemicals will follow the pattern of their early growth, and will probably double in volume by 1960. They will then be supplying 30-35% of all chemicals.**
- **Trend in raw materials for petrochemicals is toward oil, away from gas. Influencing this movement are both the rising prices for natural gas, and the desire of refiners to find more profitable uses for their light ends.**
- **More mergers and tie-in arrangements between oil and chemical companies will take place, to integrate sources of raw materials, manufacturing facilities and distribution channels.**
- **Biggest growth is seen in petrochemicals for the plastics field, where 20% of all petrochemicals may soon be going. Synthetic rubber will also have a large expansion.**

PETROCHEMICALS are on the upsurge again this year—after a slight slackening in 1954 of the rapid growth they've been experiencing during the past decade.

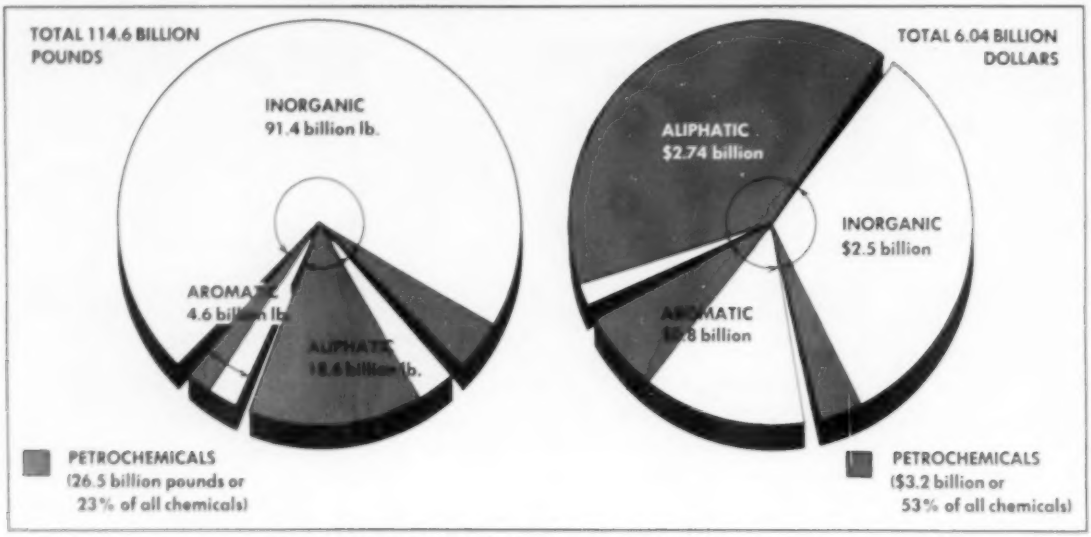
Last year output was 26.5 billion lbs., only 4.7% over the 1953 output. That was peanuts compared to the 18% growth experienced the year before.

But by mid-1955 it appears that this lusty offspring of petroleum and chemicals is resuming its stride. Over-all output this year is predicted at around 31 billion lbs., a jump of nearly 17% over 1954.

Looking ahead to 1960, some authorities believe that production of petrochemicals then will be around 60 billion lbs., about double that of 1955, and that one third of all chemicals will then be petrochemicals. Some oil company authorities who are deep in the petrochemical business, however, think these 1960 forecasts are somewhat optimistic.

Data on the 1954 output of petrochemicals was prepared by Dr. R. L. Bateman, Director of Product Development for Carbide and Carbon Chemicals Co., in a projection of studies made for PETROLEUM PROCESSING a year ago. While total production was only 4.7% higher than in 1953, this gain was higher than the increase of 2.6% in the 1954 output of all chemicals.

Large gains in output of aromatics took place in 1954, reflecting the growth of catalytic reform-


TOTAL 114.6 BILLION POUNDS
INORGANIC 91.4 billion lb.
AROMATIC 4.6 billion lb.
ALIPHATIC 18.6 billion lb.
PETROCHEMICALS (26.5 billion pounds or 23% of all chemicals)
TOTAL 6.04 BILLION DOLLARS
ALIPHATIC $2.74 billion
INORGANIC $2.5 billion
AROMATIC $0.8 billion
PETROCHEMICALS ($3.2 billion or 53% of all chemicals)

OUTPUT AND VALUE of all chemicals produced in U. S. last year

ing installations in refineries. There were gains also in inorganic petrochemicals, mostly in ammonia. However, there was a drop in the production of the largest group—the aliphatics. This was largely due to the falling off in demand from the textile, synthetic rubber and automatic supply fields.

In value, the 1954 crop of petrochemicals was $3.17 billion, a drop of $50 million from 1953. The decline was entirely in aliphatics, the value of the aromatics and inorganics being much higher.

For 1955 Dr. Bateman predicts a total output of 31 billion lbs. Dr. Bateman estimates 1955 petrochemical output will be made up of 19 billion lbs. of aliphatics, 3.2 billion aromatics, and 8.8 billion inorganics. Sales value of the 1955 petrochemical production will be $3.65 billion. Details of his figures on product output and value for all three years—1953, '54, '55—are shown in the table on pg. 1387.

Dr. Bateman's figures are pretty much in agreement with data Dr. Carl O. Tongberg of Esso Research and Engineering presented before the Interstate Compact Commission recently. Dr. Tongberg put the 1955 output at 30 billion lbs. Of the total, he estimated around 19 billion lbs. will be aliphatics, 3 billion aromatics, and around 8 billion inorganics.

Current capital investment in petrochemical manufacturing facilities is put by various authorities at approximately $4 billion, a gain of $500 million over 1954.

Looking ahead a year, Dr. Bateman estimates 1956 output at 35 billion lbs., of which aliphatic petrochemicals will be 21 billion, aromatics 3.5 billion, and inorganics about 10.5 billion. The indicated rate of gain from his 1955 estimates would be 12.5%.

By 1960 total petrochemical output will be 60 billion lbs. Dr. Bateman believes. This would be in line with the industry's earlier pattern of doubling its production every 5 years. Petrochemicals will then be supplying a third of the total chemicals output of 178 billion lbs. The estimated breakdown of the groups of petrochemicals in 1960 is 40 billion lbs. of aliphatics, 5 billion of aromatics, and 15 billion of inorganics. Capital investment in the petrochemical industry in 1960 will be around $8 billion.

That the growth in capacity and volume of output of petrochemicals will follow the pattern of 1950-55 and double again by 1960 is also the belief of Dr. W. E. Kuhn, General Manager, Research and Technical Dept., The Texas Co.

"As an index to continued growth," he stated, "it was estimated in 1951 that of all chemicals then being manufactured in this country, 25% were petrochemicals. From that base it was estimated that in 1962 approximately 50% of all chemicals will be petrochemicals. Present trends indicate this figure will be realized, and probably sooner than estimated; possibly as early as 1960."

These estimates for 1960 petrochemical growth are too optimistic, some oil companies believe. One authority with a large eastern oil company believes new plants are not now building at a rate that will enable the industry's output to be doubled by 1960. Another refers to the 1952 report of the President's Materials Policy Commission. While different base figures were used then, the rate of growth in primary petrochemical requirements from 1950 to 1960 was estimated at 45%.

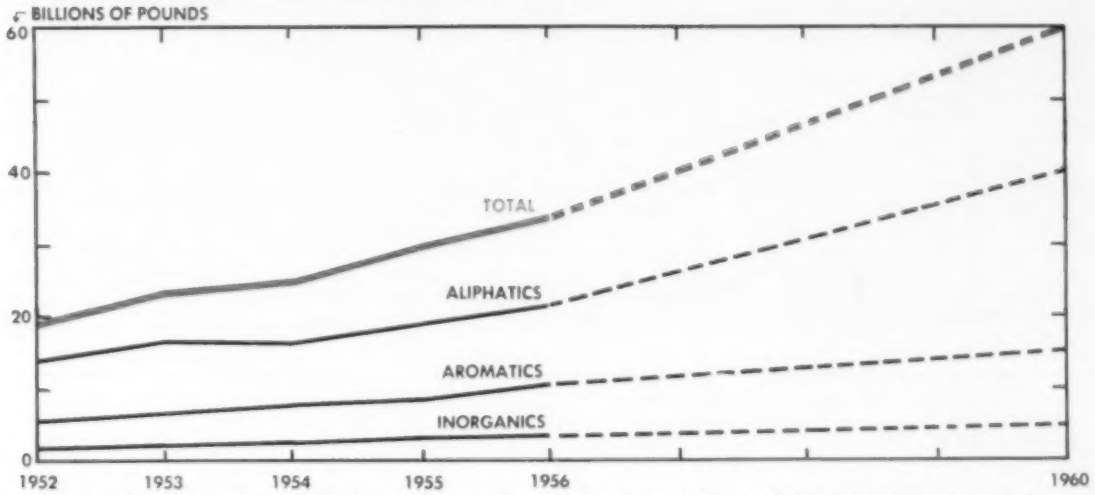
Raw Materials

PRICE rather than volume of supply will continue to be the overall index to whether natural gas or petroleum fractions are selected as raw material for petrochemical manufacture. The present large tonnages of petrochemicals require only about 1% of the total crude oil and natural gas production in the U. S., and not over 3% if the fuel consumed in their manufacture is included.

Natural gas as raw material will come under closer scrutiny in the future for two reasons, (1) the upward trend in prices at the wellhead, and (2) the confusion as to the regulation of gas prices caused by the Supreme Court's decision in the Phillips case.

The trend in gas prices is already bringing this raw material closer to a competitive base with petroleum. The average wellhead price to gas producers in 1954 was 10.0¢ per MCF., compared with 9.2¢ in 1953, and 6.5¢ in 1950, when many of the present long term gas contracts were written. Present new contracts are being written on the basis of 15¢ in

PRODUCTION OF PETROCHEMICALS IN THE U.S.



PREDICTION FOR 1960—U. S. petrochemical output (including crudes used direct as fuel components, solvents, etc.)

the smaller gas producing fields, where the petrochemical plant payout term will be shorter than in the large gas fields. In the latter, the base for new contracts is said to be around 20¢, close to the point where it may be uneconomic to use gas in the manufacture of chemicals where the price of the raw material is a large proportion of the total manufacturing cost. A wellhead price of 25¢ is the point where the conversion of petrochemical plants to petroleum will start in earnest, in the opinion of some authorities.

On the second factor, if Congress takes no action to remove the uncertainty over the control of the price of gas, the possibility is seen that some of the large oil companies and large gas producers may desire to sell for intrastate use and thus avoid whatever form of federal control develops. This might make for a lower price to new chemical manufacturers who could locate in the state of their gas supply.

About one-fourth of the liquefied petroleum gas produced in the U.S. is now used for chemical manufacture, including synthetic rubber. The volume so used in 1954 was 1,358 million gallons, 60% more than in 1950. Due to the growth in the volume of production, the contract price for LPG in tank cars Group 3 dropped from nearly 4¢ per gallon at the end of 1954 to around 2.5¢ in the summer of 1955. One large LPG producer recently advanced its price 0.5¢ per gallon. No trends are now foreseen that would carry the price for 1956 above the prevailing 1954 level.

Mergers, Tie-ins

Coming years will see more integration of the manufacturing and selling of petrochemicals, through expansion of individual companies, mergers of existing companies and other forms of tieups between oil company manufacturers and chemical concerns with established market research and sales departments. Such combinations will make possible the long range development programs which smaller concerns in both the petroleum and chemical fields will find difficult to accomplish individually. Tie-ins between oil companies making a relatively small volume of some petrochemical, as sulfonates for detergents, for example, and the manufacturer of the detergent may prove economic.

The trend toward integration is seen in the recent acquisition of an interest in the Mid-South Chemical Corp., of Memphis, Tenn., jointly by Cities Service Co. and Continental Oil Co., and by the proposal for a merger with Monsanto Chemical Co. of Lion Oil Co. of El Dorado, Ark. In both cases the immediate purpose is to provide for the distribution of nitrogenous fertilizers made by the oil companies. The marketing of other petrochemicals they make may be a later development.

The Mid-South company will market in the central states anhydrous ammonia to be made at a plant at Lake Charles, La., which will receive its raw materials from the Conoco and Cities Service refineries there.

Lion Oil Co. is a large producer of nitrogenous chemicals, which are sold to the chemical and agricultural markets. Monsanto is a substantial consumer of ammonia and it is a large producer of phosphorous. From these two materials it produces concentrated fertilizers in both solid and liquid form. Monsanto also manufactures other agricultural chemicals, the distribution of which ties in with the nitrogenous fertilizers.

The proposal of a merger of Monsanto Chemical and Lion Oil Co. will be submitted to shareholders of both companies Sept. 22. In commenting on the proposal, Charles Allen Thomas, president of Monsanto said, "more than one-half of Monsanto's raw materials are products which can be or are produced from petroleum fractions or natural gas."

The coming integrations between petrochemical manufacturers and chemical marketers may not necessarily all be forward from the producer to the distribution channels. They may be backward from the chemical manufacturer to the source of the raw material. For illustration: Olin Mathieson Chemical Corp., expanding rapidly in the chemical manufacturing field, in 1953 purchased control of the Interstate Natural Gas Co., which held mineral rights on 455,000 acres in East Texas, Arkansas and Louisiana, with an eye to developing a source for its needed raw materials. In another instance Food Machinery and Chemical Corp., in the government's sale of synthetic rubber facilities, bought a butadiene plant at Houston. Through the recently or-

ganized Petro-Tex Chemical Corp. they will expand the butadiene output and install equipment to dehydrogenate butane.

The manufacture of petrochemical crudes and intermediates by oil companies will dovetail more closely with their straight refining operations as time goes on. One reason is that this provides refiners a means for utilizing profitably the lightest portions of the crude they process. These portions when used as fuel or for other operations inferior to processing, do not contribute their share of the cost of crude. Economic pressure will bring the refiner to find better uses for these materials.

Again, the severe processing operations refiners are employing today are closely akin to chemical manufacturing and the resulting products practically in the petrochemical class as, for example, the manufacture of components for alkylate for aviation gasoline. The processing equipment refiners install today in some instances can be adapted to the manufacture of chemical compounds, as catalytic reforming units for manufacturing aromatic chemicals. Catalytic reforming, as was brought out in PETROLEUM PROCESSING's recent appraisal of this relatively new process, also provides refiners with low cost by-product hydrogen which can be utilized in making petrochemicals.

This trend to bringing petroleum refining and petrochemical operations closer together was emphasized by Chester F. Smith, vice president of Standard Oil Co. (New Jersey) before the meeting in May of the API Refining Division. "As time goes on" he said, "the chemical business and the petroleum business will gradually merge and separately will become almost indistinguishable."

These Are the

Petrochemicals to Watch

AS THE petrochemical industry grows, output of some individual products reaches volumes that command respect from refiners familiar with trading in straight petroleum oils. A few of these individual compounds are used in volumes of 1 billion lbs. or more in specific fields. More have climbed into the half billion lb. group and still more will enter both groups in the next few years. A half billion pounds of petrochemicals is the equivalent of about 2 million barrels of petroleum oils.

Here are some of the trends in the plastics, synthetic rubber, synthetic fiber, and other chemical manufacturing groups which create the principal markets for petrochemicals:

Plastics

Polyethylene will lead in growth the next few years among the volume petrochemicals used in the manufacture of plastics. Its output of around 210 million lbs. in 1954 is expected to nearly triple by 1960. This increase will move this compound into third place in the plastics group volumewise, only the vinyl resins and polystyrene outranking it.

Boosting the consumption of polyethylene in this field will be the new type of so-called "low pressure" material, of which Phillips Chemical Co.'s Marlex, announced in early 1955, is an example. In place of using high temperatures and pressures in a polymerization reaction, this polyethylene is made by a continuous process employing a catalyst and operating at low pressures and temperatures.

The resulting product is said to have a tensile strength of 4500 psi., as against 2000 psi. for typical polyethylenes as now produced. The material does not soften or deform up to 250°F. and will withstand temperatures of 175°F. without becoming brittle. These and other superior qualities, it is claimed, will open up entirely new fields of uses for polyethylene plastics.

Phillips Chemical Co. is building a plant at Houston to make 100 million lbs. per year of this new polyethylene and other companies have also announced plans to produce it, including the Bakelite Co. and Monsanto Chemical Co.

Also fast growing in the plastics field, but smaller in volume, are the epoxy resins, relatively new products commercially and about 95% petrochemical. It is estimated they will grow from around 22.8 million lbs. in volume in 1954 to 82 million in 1960. The epoxies are said to have superior qualities as coatings and adhesives. In their finished properties they are super-phenolics, with alkali as well as acid resistance. They can be permanently hardened without heat and with low shrinkage and no hardener residue.

Production of the principal plastics compounds, which are in large part petrochemicals and will become increasingly so in the future, totaled over 3 billion lbs. in 1954, with a product value of $1.250 billions. Output of the same compounds in 1960 is estimated at close to 6 billion lbs., a gain of about 95% from 1954.

Synthetic Rubber

The acquisition last may of the government's synthetic rubber facilities is of great significance to the petrochemical industry in at least two ways. First, the stimulation of market development work and of competitive sales effort, as will come about under private ownership of the plants, will increase the share of the rubber market going to the synthetic type. Second, the research programs the companies will undertake will bring changes in the characteristics of the petrochemicals used in rubber manufacture.

Increase in synthetic rubber output in coming years will expand this market for butadiene, styrene, acrylonitrile, plasticizers and carbon black.

Total United States rubber consumption in 1955 is estimated at 1,500,000 long tons, including natural and GR-S, Buna-N and butyl rubber. Consumption in 1960 is placed at 2,100,000 tons, a gain of 40%.

The production of around 640,000 tons of GR-S rubber this year will call for 1 billion lbs. of butadiene and 320,000 lbs. of styrene, the principal petrochemical rubber components. Based on the 1960 rubber consumption indicated, GR-S output may reach 900,000 tons. This will require some 1.45 billion lbs. of butadiene and about 443 million lbs. of styrene.

The burden of meeting the demands of the growing rubber markets the next few years will fall principally on the U. S. synthetic plants. Maximum production of natural rubber is not more than 1,800,000 tons per year. This is not likely to be increased, for the large capital investments in the Far East necessary to expand output of natural rubber will not be made under the current political conditions prevailing there. World rubber demand by 1960 is placed at over 3,000,000 tons. To supply the deficiency in natural rubber, operators of the synthetic plants in the U. S. may be called upon to add 300,000 tons or more to their present capacity of 855,000 tons.

Of the specialized synthetic rubbers, production of butyl rubber, made from isobutylene and isoprene, has leveled off the past two years at about 60,000 tons per year, since the introduction of the tubeless tire on new car installations. As a result of intensive research work by Standard Oil Co. (New Jersey) interests, sole producers of this type, it is anticipated that new applications for butyl will be found in the fabrication of tires, in automotive rubber parts and other industrial services, which will bring demand for this synthetic back to its 90,000 tons output capacity and perhaps require additional capacity.

Fibers

The growth of synthetic fibers in the U. S. has been phenomenal, their production increasing more than six-fold in the past 10 years. However, only about 8 lbs. per capita per year of synthetics are now being consumed, while consumption of all fibers is around 33 lbs. As compared with the past decade, moderate expansion of the synthetics is forecast, to perhaps 30% of the U. S. fiber market in the early 1960's.

The estimate of man-made fiber consumption in 1960, by Manfred Keller, of the Du Pont company, is 1.8 billion lbs., including 950 million of cellulosics (non-petrochemicals) and 850 million of synthetics. Among the synthetics are nylon, a polymeric material derived from one or more petrochemicals, including cyclohexane, benzene, phenol or butadiene; the acrylics, major constituent of which is acrylonitrile, and the newer fibers stemming from ethylene and paraxylene.

The future large scale growth of the man-made fibers, it is stated, will come through varied industrial applications being found for them. Such a development has taken place with nylon, production of which is around 250 million lbs. a year. Of this volume about 45 million lbs. is now going into the plastics field. The strength, and moisture and abrasion resistant properties of this material will enable its use to be expanded into other fields than fabrics, such as belting, conveyors, and so on.

Carbon Black

The transfer of the U. S. synthetic rubber plants to private interests is too recent to note its impact upon the carbon black industry, but new problems in both quantities and product specifications are anticipated, according to A. F. Beede with Godfrey L. Cabot, Inc., in Boston.

The trend in plant construction will be toward the oil furnace types capable of producing higher quality blacks, even though yields are reduced and plant investment higher than with the earlier plants. In 12 months ended June, 1955, new capacity totaling 100 million lbs. has been put on stream in the U. S., and another 100 million lbs. of annual capacity is planned.

The important shift in demand from natural gas blacks to oil furnace blacks continues, as shown by a breakdown of shipments by grades from U. S. plants in 1955. Estimated shipments of channel blacks for 1955 are 26.5% of the total, compared with 28.4% in 1954. Decline in shipments of gas furnace blacks from 24.5% to 23.8% reflects high raw material costs for this type and the improving characteristics of competing oil blacks.

The most significant development in grade competition is the increase in shipments from HAF (high abrasion)

A Big Boost for Petrochemicals—from Plastics

*Sales of Plastic Compounds, 1954 and Projected 1960**

Compounds	Million Lbs. 1954	Million Lbs. 1960	% Growth	Current % Petrochemicals
Vinyls	950.2	2676.1	181.6	80
Polystyrene	1037	1407.9	35.7	50
Phenolics	400.9	521.7	30.1	50
Urea and Melamine	236	340	44.1	60
Polyethylene	210	627	198.6	100
Cellulosics	120	144	20.0	20
Acrylics	60	80	33.0	100
Polyesters	26	60.2	131.5	70
Epoxies	22.8	82	259.7	95
Nylon	15	45	200.0	60
Alkyd Molding Mat	6	9	50	—
Fluorocarbons	1.5	6	300.0	—
Total	3085.4	5,998.9	94.4	

*From "Trend in Plastics Use", Gordon Brown, Bakelite Co.; Chemical Research Assn., New York, May 19, except column showing "current % petrochemicals".

For Carbon Black—20% More this Year

U.S. Shipments and Production, 1953-1955

	1953	1954	% Change 1953-54	1955 Est.	% Change 1954-55
SHIPMENTS (Thousand lbs.)					
Channel Black	454,838	426,001	−6.3	430,000	+0.9
Total Gas Furnace	384,403	367,471	−4.4	385,000	+4.8
Oil Furnace					
HAF(1)	427,985	434,690	+1.6	511,000	+17.6
FEF	196,896	166,916	−15.2	186,000	+11.4
Thermal	97,753	105,332	+7.8	109,000	+3.5
Total	1,561,875	1,500,410	−3.9	1,621,000	+8.0
PRODUCTION (Thousand lbs.)(2)					
Channel Black	454,258	378,642	−16.6	360,000	−4.9
Total Gas Furnace	376,410	352,384	−6.4	410,000	+16.4
Oil Furnace					
HAF(1)	460,965	426,040	−7.6	620,000	+45.5
FEF	213,095	155,585	−27.0	190,000	+22.1
Thermal	106,750	101,631	−4.8	130,000	+27.9
Total	1,611,478	1,414,282	−12.2	1,710,000	+20.9

(1) HAF, high abrasion furnace, FEF, fast extruding furnace
(2) Doubled 6 months actual
Sources: Years 1953, 1954—Bureau of Mines
Year 1955—Estimated by Godfrey L. Cabot, Inc. Economics Dept.

furnaces, including ISAF (intermediate super-abrasion) and SAF (super abrasion). Shipments here were 31.5% of the 1955 total, compared with 29% in 1934. FEF (fast extrusion) oil furnace shipments increased from 11.1% to 11.5%. Thermal blacks were 6.7% of shipments in 1955, 7% in 1954.

One reason for the shift from gas blacks to oil blacks has been the extended rise in the price of natural gas. A parallel raw material situation is seen developing for oil furnace blacks, in the decline in residual fuel oil production and stocks at refineries and the definite upward trend in residual fuel prices.

Significant recent technological developments in utilization of carbon black include:

1—The adaptation of carbon black to polyethylene compounds, an extension of their application in the plastics field.

2—Incorporation of carbon black directly into the manufacture of synthetic fiber, thus coloring the fibers throughout, in place of merely giving them a surface coating.

3—Development of a new explosive using carbon black and ammonium nitrate, similar to the production of an explosive by combining lamp black and oxygen.

4—Development of a complete line of electrically conductive furnace blacks which extend the conductive properties of rubber beyond the old limits.

Ammonia

The capacity to produce ammonia, the largest volume petrochemical, has grown in this country at a greater rate than the consumption of nitrogenous fertilizers, its principal use. However, such economic factors as low cost raw materials and advantageous location relative to markets are expected to lead to further building of new plants.

In the early part of 1955 there were 35 plants in the U. S. producing synthetic ammonia and some 20 additional plants were planned or under construction, Richard F. Messing, Arthur D. Little, Inc., reported to the Chemical Market Research Assn., in New York. Capacity in 1945 was 2.8 million tons; increase to 3 million tons by the end of 1955 is expected, and to 3.8 million tons by the end of 1956. For the foreseeable future, a normal increase in nitrogen usage of about 150,000 tons a year is expected.

Among the nitrogen derivatives, emphasis is now being given to the manufacture of urea from ammonia, which has a higher analysis than other forms of nitrogen and also diversified markets outside the agricultural field. It is at present more costly per unit of contained nitrogen but there are prospects of its becoming more competitive.

The use of pesticides, soil conditioners, and other agricultural chemicals is growing even more rapidly than nitrogenous fertilizers. Many of these are petrochemicals, as maleic hydrazide for a growth retardent, for example. Farmers are now estimated to be spending $450 millions a year for this class of chemicals, about 40% of the total currently expended for fertilizers.

Sulfur

Sulfur produced as a petrochemical from natural gas and refinery operations will continue to play a minor but important role in the supply of this commodity, even though improving technology will produce more economic recovery methods, states Norman C. Updegraff, Girdler Co., Louisville, Ky. Public relations and political factors, as well as economic, will determine the feasibility of these installations.

Probably the largest new volumes will come from natural gas purification projects, where the tonnages of sulfur compounds handled per day at a single location are generally larger than at a refinery. The expansion of sulfur recovery operations in Wyoming the past few years is a good example of this trend. When the pipeline and marketing problems connected with the natural gas from Alberta Province in Canada are solved, a large increase in sulfur recovery operations will be necessary there to treat gas containing 10% to 50% hydrogen sulfide.

New technological developments may bring back direct processes which recover the hydrogen sulfide from the gas in the form of sulfur. These processes are being re-evaluated and work done on new versions. High gas pressures and hydrogen sulfide content make alternate hydrogen sulfide removal processes, such as water scrubbing, look more attractive than the conventional ethanolamine process for removing the bulk of the hydrogen sulfide, although final cleanup for pipeline purity is still required.

New techniques for transporting liquid sulfur in bulk by barge from the mines may reduce freight costs to areas served by waterways and quantity shipments of liquid sulfur by pipeline may not be so far off as many think. These may increase the competition from mined sulfur to petroleum sulfur in some areas.

Additives and Detergents

Additives for liquid fuels and lubricating oils will provide a market for over 1 billion lbs. of petrochemicals, even though their concentration in the gallon of product is tiny and not all additive products are petroleum derivatives.

Research on gasoline improvers, together with the sales promotion value of the additives to the oil companies, will develop new types for motor fuels. Their present uses include: to prevent frost forming in the carburetor, as anti-oxidants, anti-rust compounds, detergents, metal deactivators, ignition control or anti-preignition agents, and for knock suppressant, for which tetraethyl lead is used. The ignition control additives are being emphasized and they are principally phosphorous compounds which can be readily produced from petrochemicals.

Motor fuel additive concentrations vary from 0.01 to 1% by volume. For motor gasoline alone, based on a 20% increase in volume by 1960, this market for additives may be over 900 million lbs., a large part being petrochemicals.

Additives from petrochemical bases are also finding their way into other types of liquid fuels. Amyl nitrate is added to diesel fuel to help initial ignition and this chemical is also being tried out as a heating oil additive to improve combustion qualities. Additives are used in fuel oils and furnace oils to prevent sludge particles from building up to the point they clog burners.

The use of additives in motor oils and other types of lubricants is growing and many have petrochemical bases. The value of additives supplied for lube oils is now over $125 million annually.

Among the small volume petrochemicals, the synthetic detergent market has grown greatly the past 10 years and is expected to increase further. Total production of these detergent materials is around 1 billion lbs. annually. The bulk of this product continues to be alkyl aryl sulfonates, although there is a growing market for the liquid nonionic types based on ethylene oxide.

It has recently been discovered that the oil recovery in water flooding operations can be greatly helped by the addition of a detergent. This is a significant development in oil recovery and will increase the detergent market.

SYNTHESIS GAS REFORMER TUBES are made of high-nickel Incoloy to resist corrosion from the steam-methane-oxygen mixture and temperatures to 1800°F.

POLYVINYL CHLORIDE POWDER BLENDER has conical sections of solid nickel, cylindrical section of nickel-clad carbon steel to prevent plastic contamination

Alloys in your plant can give you . . .

• Product Purity
• Physical Strength
• Corrosion Protection
• Erosion Resistance

By ROBERT L. DAVIDSON
Assistant Editor

NO process is better than the materials used to fabricate the processing equipment and piping. For this reason special metals and alloys are playing an increasingly important part in today's petrochemical technology with its increasing pressure, temperature, corrosive and erosive factors.

Nickel is one of the more commonly used materials, both by itself and as an alloying constituent, due to its ability to withstand corrosive environments and to impart favorable physical and mechanical characteristics to the finished alloy. The nickel is used with various amounts of copper, chromium, molybdenum, iron, etc., to give the final alloy analysis.

Both the formulation and selection of optimum alloys for a given situation are highly specialized and depend upon many interrelated factors. Therefore it is beyond the scope of this article to attempt a detailed evaluation of each and every alloy analysis for all possible environments. The complexity of this subject is indicated by the table on page 1395, which gives a partial list of the more important nickel-containing alloys available today. In addition to those listed in the table, there are many other alloys, each specifically designed to give optimum performance under specific situations.

It is possible, however, to discuss some specific examples of alloy applications which have proven satisfactory in actual petrochemical installations.

Ethylene Pyrolysis

The furnace tubes for the pyrolysis of ethane or propane to form ethylene must be able to withstand high operating temperatures, carburization and erosion. Other important design aspects to be considered are the coefficients of expansion of the furnace tubes and the oxidation of the tube

---

The above material was gathered during an interview with technical staff members of The International Nickel Co., Inc., New York City. The photographs are by the courtesy of "Process Industries Quarterly," published by The International Nickel Co., Inc.

exterior surfaces in the radiant section of the furnace where temperatures may reach as high as 1700°F.

The ethane or propane feed to the pyrolysis furnace enters the upper, or convection, section of the furnace, flowing downward to and through the radiant section of the furnace, then out as ethylene product.

Materials of construction for the tubes in the convection section are not as critical as they are for the radiant section because of lower temperatures. The first tubes in the convection section may be of low alloy steels leading up to the straight chromium "400" series and ending finally with the austenitic high alloy steels in the radiant section, such as Incoloy or 310 stainless steel.

One of the more critical phases of ethylene pyrolysis is not in the process itself, but in the decoking of the tubes during process shutdowns. Coke is removed from the inside of the furnace tubes by reaction with steam, or a combination of steam with a small amount of air. It is during decoking that carburization of the tubes is likely to occur, especially where localized hot spots are caused by uncontrolled burning of large localized carbon deposits. Thus, as a factor of safety against overheating during decoking, high alloy tubes, such as Incoloy or 310 stainless steel, are used for resistance to carburization which would affect the physical structure of the alloy and reduce its ductility.

Another problem which must be considered in the design of ethylene pyrolysis furnaces is that of erosion in the return bends of the furnace tubes. Due to the continuous formation of a hard coke, which is carried along with the high velocity gases through the tubes, erosion on the outer radii of the bends can be appreciable.

Erosion effects cannot be eliminated, but at least can be compensated for by the use of a cast alloy containing 24% chromium and 12% nickel with an erosion allowance built into the outer radius of the bend. While this analysis has been fairly well standardized for pyrolysis furnace return bends, there are undoubtedly other compositions which would be satisfactory.

The thought has been advanced that the nickel in high nickel-content alloys may tend to catalyze the formation of excessive carbon during the pyrolysis reaction. However, two of the larger installations in the country use high nickel-content Incoloy for furnace tubes and these have not substantiated claims as to the adverse action of nickel during their operations.

Synthesis Gas Manufacture

In the manufacture of synthesis gas by the steam reforming of natural gas, the conventional procedure is to pass the feed gas through vertical tubes approximately 8 or 9 in. in diameter and up to 30 ft. long. Pressures are essentially atmospheric and temperatures are as high as 1800°F.

Supported nickel catalyst for the reaction is packed within these vertical tubes which can be made of alloys such as Incoloy, Inconal or 310 stainless steel, either cast or fabricated by rolling and welding in a longitudinal seam. In essence these tubes are merely catalyst holders operating at low stress, and may have wall thicknesses of ¼-in. or less.

Recent developments have made it more attractive to use higher pressures during the synthesis gas reaction, especially if the product gas is to be used in a subsequent high pressure ammonia synthesis cycle. Therefore, the use of natural gases with pressures up to several hundred psig or more requires stronger mechanical design of the reaction tubes during reforming.

As in low pressure, Incoloy and type 310 stainless steel tubes can also be used for high pressure reforming, but economies have been effected by the use of Incoloy in the as-extruded condition because of the ease of manufacture as compared with the more expensive cold drawing method of producing tubes. Tube diameters will be 5 in. or less. Of the two alloys mentioned, Incoloy in the as-extruded condition tends to have a higher strength at the operating temperatures of around 1800°F.

Polyvinyl Chloride Manufacture

In the manufacture of polyvinyl chloride-type plastics, it is important that traces of iron, copper, and other metals be excluded from both the synthesis and filament extrusion steps. Traces of these metals not only catalyze decomposition of the material, but also give an off-color product.

To circumvent the possibility of objectionable metal contamination, commercially pure nickel is generally used for process vessels, columns and piping. Extrusion dies for the making of plastic filaments are generally of Duranickel, a hard heat-treatable nickel alloy. This construction resists small amounts of hydrochloric acid which can form by hydrolysis due to decomposition of the plastic as a result of heat, and resists metal erosion caused by the high pressures of the extrusion step.

High Temperature Halogenations and Dehalogenations

In processes such as high temperature chlorination, fluorination, etc., the use of alloys containing high percentages of chromium and iron may be detrimental due to the formation of high vapor pressure halides of chromium and iron. These volatile metal halides vaporize into the process stream, causing excessive metal loss and possible product contamination.

To reduce the formation and vaporization of metal halides, high nickel alloys, and even commercially pure nickel, are often used for the process piping and equipment. The resulting nickel halide formed has a relatively low vapor pressure and does not tend to vaporize into the process stream.

Polyethylene Manufacture

Although the manufacture of polyethylene is conducted at relatively low temperatures, pressures may be as high as 10,000 psig or more. Therefore, to give the required strength to the small diameter tubes in which ethylene is polymerized, high strength alloys are used.

Product purity is an additional requirement for the polyethylene product, requiring such construction techniques as the use of a hard nickel plate on the steel tubes to eliminate iron contamination in the final product.

Synthetic Phenol Handling

Iron in phenol is detrimental to the further processing of the phenol to such products as phenol formaldehyde resins, pharmaceuticals, etc. Therefore synthesis equipment and storage tanks, as well as lines, coils and accessories in tank cars handling finished phenol are frequently made of commercially pure nickel or nickel-clad steel which have been adopted as a standard by the industry.

For cases where the user is not concerned about small quantities of iron in the phenol, handling and storage equipment may be of ordinary steel. The corrosion rate of steel in phenol service is small.

Other materials of construction suitable for handling phenol, where iron contamination must be mini-

mized, include tin coated materials, glass lined materials, ceramic lined materials, and other surface protective techniques using inert linings or coatings.

Hydrogen Service

In high temperature, high pressure reactions involving the use of hydrogen, there is always the danger of hydrogen embrittlement of mild steels at temperatures above 500°F. and above a certain level of pressure.

Hydrogen embrittlement is minimized by cleanliness of the structure of the steel and by tying up the iron carbide in the steel alloy by the addition of chromium. Then, in order to obtain more favorable mechanical characteristics at elevated temperatures, nickel may be added to the alloy during manufacture.

Tetraethyl Lead Manufacture

A number of potentially corrosive situations exist in the manufacture of tetraethyl lead. One of these situations is in the manufacture of metallic sodium which, though not an actual ingredient in the finished product, is used as an alloying agent for the lead.

Sodium is made from brine—from salt deposits—which is transported to the plant through Transite pipes. Brine is then filtered, evaporated and dried to form salt crystals which are then decomposed in electrolytic cells. Liquid sodium is tapped from the cells, filtered and either stored or sent immediately to the manufacturing area.

Chlorine, formed during the electrolysis of the dry salt, rises into domes made of nickel to withstand the corrosive effects of 1100°F. chlorine.

Another source of corrosion arises from sulfuric acid used in drying operations. Therefore, many of the pumps in the sodium and ethyl chloride areas have shafts and impellers of nickel alloyed cast irons, such as Ni-Resist, to resist corrosion.

Evaporators and their auxiliary equipment for salt water brine—prior to the electrolysis step—have Monel linings to combat salt water corrosion. Driers used to dry the salt crystals are exposed to a combination of wet salt and flue gases up to 480°F., therefore are lined with commercially pure nickel for corrosion resistance.

Process water effluent from the final tetraethyl lead distillation must be treated before it can be released. In this treatment, suspended solids are flocculated and the floc dissolved in sulfuric acid. The resulting solution is handled in stainless steel equipment and pumps. The acid mix feed tank for the treatment is made of 18-8 chromium nickel stainless steel.

Synthetic Detergents

In the manufacture of alkyl aryl sulfonates a number of process steps have corrosive potentiality. For instance some of the chemicals encountered are caustic soda, sulfuric and sulfonic acids and small amounts of hydrochloric acid.

An additional requirement is that product soap solutions must be protected from contamination, for even slight traces of iron may eventually cause unwelcome odors or instability.

Due to the corrosivity of process streams and the need to eliminate trace iron from the product, much of the processing and storage equipment is made of materials such as Monel, stainless steel, Hastelloy alloys and glass.

One of the first sources of corrosion in the process results during the reaction of polymerized olefins and benzene to form dodecyl benzene which is called alkylate. Excess benzene distilled from the alkylate contains small amounts of hydrochloric acid, thus the system requires Monel lines and condensers.

In a subsequent process step, namely the neutralization of purified alkyl aryl sulfonic acid with caustic soda, a monel mixing tank is used.

For the remainder of the process, corrosion resistant metals are used primarily to protect the final product from contamination with trace iron.

Synthetic Glycerine Manufacture

A synthetic glycerine process reacts propylene with chlorine to form allyl chloride. Subsequently the allyl chloride is converted through intermediates to form glycerine.

Chlorine in the process stream must be allowed for in the selection of materials of construction. For the initial reaction of chlorine and propylene, the mixing jets in the reaction chamber are made of Inconel, which is highly resistant to chlorine corrosion.

Following the synthesis of glycerol from allyl chloride, a mixture of glycerol plus water plus salt is obtained. This solution is concentrated in multiple effect evaporators made of nickel clad steel and equipped with solid commercially pure nickel piping.

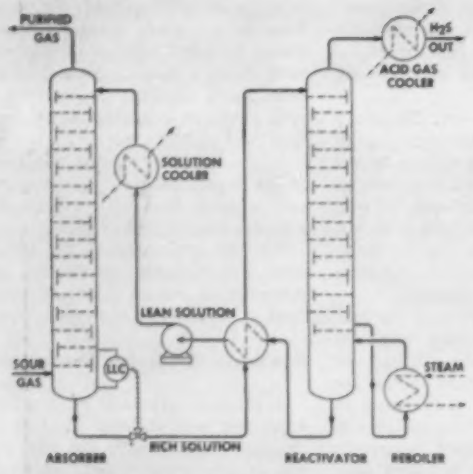
The salt is next separated in centrifuges made of Monel, and the glycerol effluent is stripped from the concentrate with steam under reduced pressure in nickel clad evaporators.

Glycerol is finally distilled in a nickel clad steel column under high pressure and stored in tanks made of the same metal. The finished product therefore has a negligible amount of heavy metals content.

Nominal Compositions of Typical High-Nickel Alloys

	% Nickel	% Copper	% Chromium	% Iron	% Silicon	% Manganese	% Carbon
Monel*[1]	67	30	—	1.4	0.1	1	0.15
Nickel[1,2]	99.4	0.1	—	0.15	0.05	0.2	0.1
Inconel*[1,3]	93.65	0.2	15.5	7.5	0.25	0.25	0.08
Incoloy*[1,4]	30.00-34.00	0.50 max.	19.00-22.00	Bal.	1.00 max.	1.50 max.	0.10 max.
Nionel*[1]	40	1.75	21	31.	0.40	0.60	0.05
Ni-Resist (Type 1)*[6]	13.5-17.5	5.5-7.5	1.75-2.50	Bal.	1.0-2.5	1.0-1.5	3.00 max.
Ni-Resist (Type 2)*[6]	18.0-22.0	0.5 max.	1.75-2.50	Bal.	1.0-2.5	0.8-1.5	3.00 max.
Ni-Resist (Type 3)*[6]	28.0-32.0	0.5 max.	2.5-3.5	Bal.	1.0-2.0	0.4-0.8	2.75 max.
Type 302 Stainless Steel[7]	8	—	18	Bal.	—	—	0.10
Type 304 Stainless Steel	9.0	—	19	Bal.	—	—	0.08 max.
Type 310 Stainless Steel	20	—	25	Bal.	—	—	0.25 max.

(1) Also available in clad steel
(2) Includes small amount of colbalt
(3) Includes 4.5% aluminum
(4) Sulfur content, 0.030% maximum
(5) Includes 3.0% molybdenum
(6) Available in cast form only
(7) Also known as 18-8 stainless steel
* Trade Marks of The International Nickel Co., Inc.



TYPICAL high-pressure natural gas purifying unit

How the Process Works

The Girbotol process is based on the reaction of acid gases, H_2S and CO_2, with certain amines:

$$RNH_2 + H_2S = RNH_3HS$$

$$RNH_2 + CO_2 + H_2O = RNH_3HCO_3$$

(Where R represents an organic radical)

These reactions are reversible and the equilibrium proceeds to the right or left, depending on the temperature, and on the partial pressure of the gases.

It is a continuous process in which the solution passes through the absorber, where the acid gas is removed from the natural gas, through heat exchange, and into the reactivator. Here hydrogen sulfide and/or carbon dioxide is stripped from the rich solution by heat and passes out of the tower as a concentrated gas, together with some steam, into the acid gas cooler. The steam is condensed in this cooler and returned to the cycle.

The reboiler at the base of the reactivator supplies the heat necessary for the process. Although steam is shown on this diagram, other sources are being used successfully, such as hot oil and direct firing.

The lean solution, essentially free of acid gases, passes from the bottom of the reactivator, through heat exchange, and back to the absorber.

How to select equipment to . . .

• Prevent Solution Carryover
• Remove Accumulated Sludge
• Provide for Regeneration

. . . in gas purification units

By NORMAN C. UPDEGRAFF, Asst. Technical Director
Gas Processes Division, The Girdler Co.
Louisville, Ky.

THE Girbotol process is widely used for the removal and recovery of hydrogen sulfide from both gaseous and liquid hydrocarbon streams, and for the separation of carbon dioxide from hydrogen and synthesis gases. There are several hundred Girbotol units in operation at present.

In the petroleum field hydrogen sulfide removal units are in universal use on refinery and natural gas applications, many of them supplying hydrogen sulfide to sulfur recovery units for the production of elementary sulfur.

Carbon dioxide removal units range in size from small inert gas purifiers to large ammonia synthesis gas operations.

Of the several processes that have been used for such gas purification operations, the Girbotol process is the only one to reach such a wide degree of acceptance in so many fields, and many units originally using competing processes have since been converted to this process.

The equipment used in these units generally consists of conventional vessels, heat exchangers, pumps, instruments and auxiliaries well known to the petroleum processing industry. Throughout the more than 25 years that the basic process has been in industrial use, however, a number of problems and applications have turned up which required the use of special equipment design and which have dictated the choice between the various types of equipment available for the major items. This article will describe some of these considerations as they apply to the use of the Girbotol process in the petroleum processing industry.

Materials of Construction

Since a great deal has been published elsewhere on corrosion observed in various operating plants only those factors that affect equipment design need be considered here.

Corrosion of equipment has been a serious problem in some Girbotol plants, while in others little difficulty has been experienced. These plants normally are built entirely of iron and steel, since amine solutions, like ammonia, will dissolve copper and brass and most alloys containing zinc or copper. Aluminum has been utilized

to some extent, although it is susceptible to attack in the presence of iron sulfide.

Rich solution piping and control valves occasionally are subject to corrosion, particularly in cases in which erosion also occurs due to the abrasive action of iron sulfide sludge in the solution. Control valves are normally trimmed with stainless steel, but carbon steel pipe generally has a satisfactory service life.

Absorption Equipment

Absorption columns are conventional type towers designed to operate at the full line pressure of the gas or liquid to be purified. This pressure may be several hundred pounds in the case of natural gas purification. Both bubble tray and packed columns have been used successfully in most applications, with the choice depending largely on cost. In recent years, however, the trend has been more toward the use of towers packed with Raschig rings. There are fewer design variables in packed tower work, as against the many factors such as cap spacing and size, submergence, seals, weir length and general tray arrangement which attend the use of bubble cap trays.

The large differences in gas throughput capacities which have sometimes been found between bubble plate and Raschig ring packed absorbers when treating refinery gases with amine solutions for hydrogen sulfide removal, have been traced to the presence of organic acids in these gases which produce foaming tendencies in the solutions. The conditions in a bubble plate tower, where the gas bubbles through successive layers of liquid, are such as to produce maximum frothing in the solution, with resultant liquid holdup and carryover. In a packed absorber, the gas does not bubble through the liquid at all, but passes over surfaces wetted by the liquid, so that there is no pronounced tendency for foaming to occur.

When the Girbotol Process is used for purifying liquid hydrocarbons a packed or sieve plate tower is used for the absorber and either the liquid hydrocarbon or the ethanolamine solution maintained in a continuous phase, depending upon the specific case.

Absorbers usually are free from corrosion difficulties, although at least two cases have been reported in which corrosion cracks appeared near welds in absorber shells and piping after about two years service. This was apparently due to stress corrosion, which can generally be avoided by good fabrication techniques followed by thermal stress relief in an annealing furnace.

Reactivation Equipment

In general, the reactivator towers are similar in design to the absorption vessels except that they generally operate at pressures less than 50 pounds. Bubble plate and packed towers have both been used in this service, with the choice again being dictated largely by cost and service conditions.

Reactivators have been subject to corrosion in a few plants. In one plant, corrosion occurred to such an extent that the reactivator was replaced after five years' service, and in another plant the reactivator shell was protected by an outer lining after three years' service. In both of these plants the natural gas being purified contains more CO_2 than H_2S, and it is felt that the corrosion has been accelerated by the presence of the CO_2. These plants both circulate aqueous monoethanolamine solutions.

The use of Gunite concrete linings plus the use of stoneware packing has proved successful in overcoming corrosion problems in a number of reactivators.

Heat Exchange

Heat exchange equipment used in Girbotol plants consists generally of standard tube and shell bundles. In smaller plants, such as well head natural gas purification units, the use of finned tube sections is frequently practical.

When standard tube and shell units are used in solution exchangers, precautions must be taken to avoid erosion due to high velocities and the abrasion of iron sulfide, which is sometimes found in the solutions. Designing nozzles for low entrance velocities and the use of suitable impingement baffles have largely solved this problem. Corrosion of carbon steel exchanger tubes on the rich solution side has occurred at times, but the frequency of occurrence of such corrosion has not been great enough to warrant the general use of alloy tubes in solution heat exchangers. In addition to corrosion on the process side, there have been other cases of corrosion reported due to corrosive steam or cooling water, which corroded the carbon steel tubes of the equipment it has been used in.

Reboilers used in most Girbotol units are the standard kettle type with an overflow baffle to maintain the liquid level over the tubes. When heating mediums other than steam are used for reboiling the ethanolamine solutions, such as hot oil, special precautions must be taken to avoid leakage into the system. Hairpin tubes are preferred in such cases rather than floating heads. Gunite lining of reboiler shells has been used successfully where corrosion has been a problem.

A number of installations have been made with thermo-syphoning reboilers to reduce the retention time of the solution at high temperature and to lower the skin temperature of the tubes due to higher solution velocities and less opportunity for fouling due to sedimentation. Thus the probability of solution decomposition is reduced.

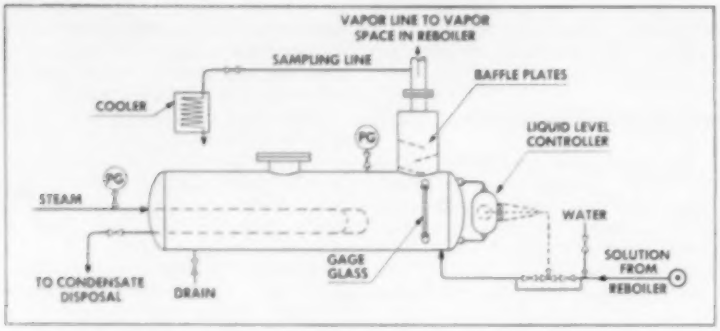
Equipment-wise, the acid gas coolers are completely conventional condensers and gas coolers, although certain process modifications have been found helpful in solving corrosion problems found in special cases.

Mist Elimination

Since the Girbotol solutions are more costly than many streams employed in the petroleum industry (for example, the oil used in conventional gasoline absorption plants), their conservation becomes a matter of economy. A major potential source of solution loss is carryover of mist from the absorber towers. In addition to designing these vessels to reduce carryover due to high velocities and foaming, the use of a suitable mist separator has noticeably increased the gas capacities of the absorbers.

In one installation containing two identical absorbers 54 in. in internal diameter, with bubble trays having 24 in. spacing, liquid entrainment amounting to 48 gal./day occurred with one absorber when treating 18 MM. Scf./day of natural gas at 190 psig. pressure and 74° F., while the second absorber handled the same gas load with no measurable entrainment. Examination of the first absorber showed that the mist extractor was inoperative, and that liquid entrainment from the top bubble tray was being carried out of the absorber by the gas stream. After this was corrected, no further entrainment occurred.

Commercial mist eliminators have been found quite satisfactory. These may be internal, such as knitted metallic mesh blankets or baffled sections installed above the packing or top plate in the absorber; or external,



REDISTILLATION UNIT keeps ethanolamine solution free of sodium thiosulfate accumulation by continuous steam stripping of a small side stream of the amine solution

such as knockout drums or standard commercial pipeline separators on the outlet gas piping. In either case they perform the function of separating liquid from gas by changing the direction and velocity of flow of the gas. The liquid thus separated is drained back to the absorber.

Anti-foaming Agent Injection

In spite of proper tower design and the installation of mist eliminators, solution carryover from the tops of absorber towers has occurred in several plants. In common with other alkaline solutions, amine solutions will react with organic acids to form salts, many of which have soap-like properties, and will cause the solutions to foam when present in them. Organic acids are present at times in natural and refinery gases, and in such cases will promote foaming in amine solutions. This foaming may seriously decrease the gas handling capacity of the absorber.

Fortunately, however, it has been found that the addition of small quantities of suitable anti-foaming agents to the amine solutions will overcome the foaming tendency of the solutions.

The equipment used for the addition of anti-foaming agents generally consists of a small feed tank containing the agent and a chemical proportioning pump of commercial design. The pump speed or stroke is set to give the proper addition rate of the anti-foam agent and operates continuously, subject to routine checks by the operator.

Solution Regeneration

In most natural gas or refinery operations the ethanolamines used in the Girbotol solutions will not deteriorate appreciably in normal operation. In some cases, however, the decomposition of the amine or formation of thiosulfate has required the addition of equipment to regenerate the solutions.

Decomposition of amine solutions has occurred in a few cases. For example, the monoethanolamine in one Girbotol process plant solution was completely converted to diethanolurea by reaction with carbonyl sulfide present in traces in the gas being purified. In another case monoethanolamine was converted into N-ethanolacetamine by reaction with ketene. Neither of these compounds is alkaline, and neither is convertible back to monoethanolamine on boiling in an aqueous solution.

Another source of contamination of the amine solutions has been in the formation of thiosulfate. This occurs when solutions containing sulfides are contacted with oxygen, present either in the gas stream or by exposure of the solutions to air. The most common case in which thiosulfate accumulation occurs in the amine solution is in plants in which gas collected in vacuum gathering systems is being purified. This gas will frequently contain as much as 0.5% oxygen, present due to air leakage into the system.

Oxygen is also sometimes present in some refinery gases resulting from catalytic cracking operations. When both hydrogen sulfide and oxygen contact an alkaline solution, such as a sodium carbonate or an amine solution, oxidation of the sulfide occurs, resulting in the formation of thiosulfate.

Thiosulfates are relatively stable salts, and amine thiosulfate does not dissociate on heating like amine sulfide or carbonate, so that the presence of amine thiosulfate in the solution decreases its effective amine concentration by a corresponding amount. By adding caustic soda ash to an amine solution containing amine thiosulfate, sodium thiosulfate will be formed and the combined amine will be liberated. In this way the effective amine concentration of the solution may be maintained, until the solution becomes saturated with sodium thiosulfate.

It will then become necessary to separate sodium thiosulfate from the amine solution. This is generally done by steam distillation in which the amine is stripped out of the solution. The operation can be carried out either batchwise to reclaim a complete charge of solution at one time, or it may be carried out as a continuous operation on a small side stream of the amine solution.

The apparatus used for this side-stream redistillation generally consists of a small steam heated kettle similar in construction to the main plant reboiler. Hot ethanolamine solution is fed into the shell of the still through a valve operated by a controller which maintains a liquid level above the heating surfaces in the still. The overhead vapors from the still are fed back into the reactivator. As the solution boils in the still the water is distilled out and the solution becomes concentrated. As the concentration increases, some ethanolamine is vaporized and passes overhead with the water vapor. Finally the concentration of ethanolamine in the still reaches the point where the overhead vapors have as high a concentration of ethanolamine as the feed solution. From this point on there is no change in the composition of the solution in the still except for the gradual accumulation of salts being separated from the amine solution. These gradually cause an increase in the boiling point of the solution in the kettle and eventually require that the solution feed be shut off, water added to distill out residual ethanolamine, and the resulting salt solution dumped out and discarded. The redistillation unit is then placed back into operation.

Solution Clarification

Sludge accumulations in amine solutions have proved troublesome at times. The sludge, ordinarily consisting of iron sulfide and sulfur, is carried into the absorber as a dust with the gas stream. Microscopic examination of sludge taken from an amine solution has shown it to be identical with material present in core samples taken from the gas producing formation. Since iron sulfide is not readily wetted by hydrocarbons, the dust does not settle out of the gas stream in

photo courtesy De Laval Separator Co.

ACCUMULATED SLUDGE can be removed from amine solutions with a centrifuge, such as the one shown above, or a filter

condensate separators, but is carried on into the absorber, where the amine solution scrubs it out of the gas. Iron sulfide sludge will also be present in amine solutions in cases in which corrosion of pipelines and equipment is occurring with the formation of iron sulfide.

Although the sludge accumulation occurs at a rate of only a few pounds per day, it frequently becomes troublesome in natural gas purification plants unless steps are taken to remove it from the system. When present in sufficient quantity, iron sulfide sludge may foul heat exchanger surfaces, erode metallic surfaces at points of high solution velocity and plug bubble tray and packed towers.

Various methods have been used for overcoming sludge problems, such as the periodic cleaning of equipment with water and with inhibited hydrochloric acid, and the use of water scrubbers on the gas stream before it enters the absorber. A more satisfactory solution to this problem, however, is to clarify continuously a side stream of the circulating amine solution by means of a filter or a centrifuge.

Due to the fine particle size and the relatively slow settling rate of this sludge a centrifugal separator such as those used under pressure for clarifying steam turbine lubricating oil has been used with considerable success. One has been in operation on a large natural gas purification plant since 1950 and has proved very satisfactory in maintaining a clean solution. This unit (see photo) operates on a side stream of the lean solution taken from the discharge side of the solution pump. The clarified solution is returned to the suction side of the pump since the pressure rating of the clarifier is not adequate to take the full discharge pressure of the pump. Since it is impractical to discharge the solids collected continuously without losing too much amine solution, the unit is shut down periodically, the basket removed, and the sludge scraped out. This operation takes about half an hour and normally is only performed once or twice a shift unless an upset in operation produces an excess of sludge.

Unfortunately, these centrifuges are rather expensive for use in small plants and some type of filter is used instead. There is no one type that has proven satisfactory in all cases. Perhaps the most simple and inexpensive is a filter which consists of a chamber packed with hay. Periodically the filter is cut out of the line and the hay removed and discarded. The main disadvantage of the hay filter is that it is messy to handle and appreciable amine solution can be lost in discarding the fouled hay.

Other filter types that have been used include bag filters and helically wound wire elements precoated with filter aid.

Pumps

Pumps used for circulating the ethanolamine solutions are generally standard refinery type centrifugal pumps which may be driven with electric motors or steam turbines depending on the economics of the particular situation. Explosion proof motors, starters and switch gear are used in refinery and natural gas treating applications. Frequently a very favorable energy balance can be obtained by expanding high pressure steam in steam turbines to drive the solution pumps and utilizing the exhaust steam in the reboiler. Smaller units operating at high absorber pressures and low solution circulation rates may use reciprocating pumps, steam or electric driven.

When the absorber pressure is sufficient to deliver the solution to the reactivator, one solution pump is used, with a spare to be used when repacking or repairing the pump or driver. When the absorber pressure is insufficient, two solution pumps are used, one on the rich solution and one on the lean, with a common spare pump.

When properly placed in the circulation system, solution pumps are not generally subject to corrosion. Erosion from iron sulfide sludge can become a problem, however, if not properly controlled. As in all parts of the ethanolamine system, copper bearing alloys cannot be used but cast iron and steel are perfectly satisfactory. Stainless steel may be used for critical parts if the maximum protection is desired.

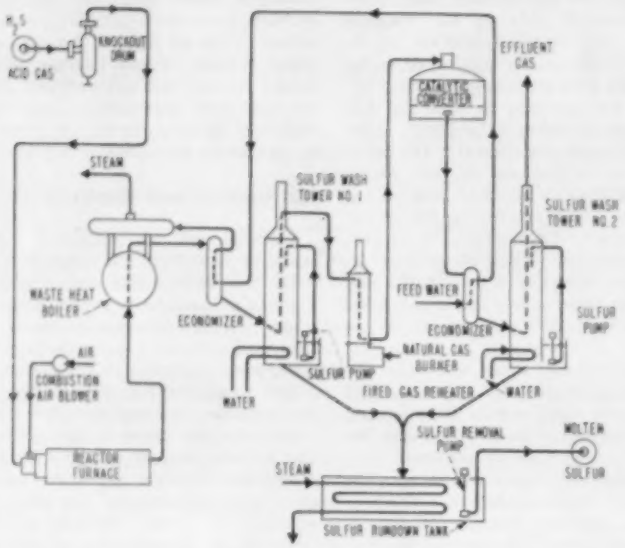
Instruments and Controls

Girbotol units are completely automatic in operation and require relatively few instruments and controls. These are standard type instruments, which may be either pneumatically or electrically operated, and consist of a liquid level controller on the absorber, a flow controller for the solution to the absorber, pressure and flow controllers for the steam to the reboiler, and a back pressure contoller on the reactivator. Pressure gages, thermometers, gage glasses and the like are supplied for visual checking of the operation. In general it has not proven practical to place an automatic analyzer on the purified gas since the units will generally have enough reserve capacity for normal increases in hydrogen sulfide or carbon dioxide and alarms can be provided to warn of complete shutdown. Periodic checking of gas purity, however, is usually carried out by the plant operators to insure consistent operation.

Conclusion

From the foregoing it may be seen that the types of equipment used in Girbotol gas or liquid purifying units are not unusual and are well known to the petroleum industry. Hidden behind these outside appearances are details of equipment design learned over more than 25 years of experience in the field which make the majority of the units operate satisfactorily for years on end.

Occasionally, however, as in any petroleum process, a maverick turns up that seems to defy convention. None of the normal solutions seem to alleviate its problems. The operating conditions appear to be the same as similar units performing without a murmur but something intangible is different. Such plants give any process a black eye but the problems, when solved, add new pages to the volumes of know-how that go into the specifications and design of equipment for future units.



How the Process Works

The sulfur recovery plant is fed with a hydrogen sulfide rich gas from a gas scrubbing plant (such as a monoethanolamine plant). The stoichiometric amount of air required to reduce the hydrogen sulfide to elemental sulfur is charged to the reactor furnace with the hydrogen sulfide gas (acid gas).

After removing the sulfur formed in the furnace, the gas contains sulfur dioxide (formed in the furnace) as well as unreacted hydrogen sulfide. These gases are further reacted in the presence of a pelleted activated bauxite catalyst to produce more elemental sulfur.

The reactions in both the furnace and the catalytic converter are exothermic, and the heat generated is used to generate steam to drive the combustion air blower and heat the molten sulfur lines and the rundown tank to prevent sulfur solidification. Sulfur in the rundown tank is held at 270 to 280°F.

How to select equipment to . . .

• Recover Waste Heat
• Avoid Metal Sulfiding
• Secure Flexibility

. . . in sulfur recovery units

By DELLASON BRESS
Foster Wheeler Corp.

FOR trouble-free operation of plants recovering sulfur from hydrogen sulfide bearing gases, the following considerations must be included in the design:

1—Water and hydrocarbons in the stock gas.
2—Gas toxicity.
3—Corrosive conditions of the reacted gas.
4—Sulfur condensation.

In the Foster Wheeler process, of which the flow diagram is typical, these conditions are controlled in the design of each piece of equipment.

FEED GAS

One factor, which is often overlooked in the operation of sulfur recovery plants, is the condition of the feed gas introduced into the sulfur recovery plant.

For most efficient operation, it is important that water and hydrocarbons in the feed gas be minimized. In the "gas cleaning" plant, which usually precedes the sulfur recovery system, the acid gas (mainly hydrogen sulfide) is separated from the hydrocarbon gases. This acid gas is then processed for sulphur recovery.

The feed gas is usually received in a water saturated condition and should be at a temperature not over 100° F. with less than 1.0% hydro-carbons.

Heat is required to evaporate water. Accordingly, any excessive amount of water will affect conditions in the reactor furnace. Slugs of water, or of amine scrubbing liquor, caused by condensation in the feed line can stop combustion in the furnace.

In addition, this condensate may cause an excessive pressure drop re-

sulting in stalling of the combustion air blower. Such an experience has occurred and resulted in sulfur bearing gas blowing back from the furnace into the blower, whereupon the condensed sulfur caused a shutdown.

An additional harmful effect of excessive amounts of water in the feed gas is that water is a product of the furnace reaction and the subsequent catalytic reduction of hydrogen sulfide to sulfur. Thus, minimizing the amount of water in the feed gas will tend to increase the overall conversion.

In essence, recovery of sulfur from hydrogen sulfide depends upon adding a stoichiometric quantity of combustion air to reduce the hydrogen sulfide to sulfur and water.

It is also necessary to add enough air to completely burn any hydrocarbon present to form carbon dioxide and water. Thus, excessive amounts of hydrocarbons in the feed gas affect the efficiency of conversion, even though combustion continues.

Heavier hydrocarbons are particularly difficult to burn in the reaction furnace, where the oxygen supply is limited. In cases of this sort, the exact mechanism is not clear, although it is probable that carbon monoxide, carbonyl sulfide and even elemental carbon are formed. The results from heavy hydrocarbons are reduced conversion efficiency, poisoning of the catalyst and off-color sulfur product.

In order to keep gaseous hydrocarbons in the feed gas from causing trouble in the sulfur recovery plant, it is essential that a properly designed and operated gas cleaning plant be employed to remove the hydrogen sulfide from the hydrocarbon gas.

GENERAL CONSTRUCTION

Hydrogen sulfide is a highly poisonous gas, and it is only at very low concentrations that its distinctive "rotten egg" odor is detectable. When present in higher and dangerous concentration, no odor is detected.

Although sulfur recovery plants operate at a low pressure, it is important that piping and equipment be made from extra heavy steel. This specification also covers all valves and fittings. Cast iron, or other easily breaking material, must not be used.

The plant is designed to prevent condensation of sulfur in the process gas ducts. All ducts are of carbon steel, internally lined with refractory or light weight insulation to protect against sulfiding in cases where the sulfur bearing gases exceed 600°F. in the ducts.

Knockout Drum

As mentioned above, slugs of entrained scrubbing liquor, or condensed water, can stop combustion in the reaction furnace. It is therefore important that a knockout drum of ample capacity be provided.

The knockout drum should be drained periodically and checked after any gas cleaning plant upset.

If the feed gas is free from oxygen, corrosion in the feed gas line is not a problem, despite its water content. For this reason, the line and knockout drum may be of carbon steel.

Reactor Furnace

The Foster Wheeler reactor furnace is designed to permit easy operation and wide flexibility of load with low maintenance and a low initial cost.

The furnace burner is simply designed, with the feed gas entering the furnace through a refractory ignition ring. Combustion air is introduced through a tangential connection into a plenum chamber ahead of the ignition ring. The gas and air are thus thoroughly mixed in a refractory lined combustion chamber.

From the combustion chamber, the gas passes to the reaction portion of the furnace. Additional refractory baffles are provided in the furnace to insure completion of the reaction at a temperature which corresponds to the gas analysis.

The temperature and conversion efficiency in the furnace depend on the "richness" of the gas, which may contain from 30 to 90% hydrogen sulfide with the balance being carbon dioxide, water and hydrocarbons. Entering gas and air velocities are controlled to suit the analysis of the feed gas for maximum conversion efficiency.

Sulfur vapors above 600°F. cause sulfiding of carbon steels or nickel bearing alloys. Although the Foster Wheeler reactor furnace is constructed entirely of carbon steel, it is amply protected against sulfiding through the proper application of a refractory lining. The shell is maintained at a low temperature through the use of insulating fire brick.

Low maintenance is provided by designing the furnace for low heat liberation. The furnace is thus sized large enough to permit the completion of the conversion reaction. Furnace temperatures vary from 1600 to 2300°F., depending on the richness of the feed gas.

Visible access to the furnace for control or combustion conditions is provided by means of a sight port in the burner front, constructed of first quartz material. Thus the flame may be noted during operation, as a check on the condition of the entering feed gas, with respect to moisture and hydrocarbon contents, as well as the air-gas mixture.

Waste-Heat Boiler And Economizer

The Foster Wheeler process carefully controls the rate of cooling of the reacted gases leaving the furnace to obtain condensation and collection of the sulfur product. The system is designed so that even at loads as low as 30%, sulfur is not condensed except in the units designed for condensing and collecting molten sulfur.

The heat removed from the hot gases leaving the furnace is used to generate steam. This steam may be used to drive the combustion blower

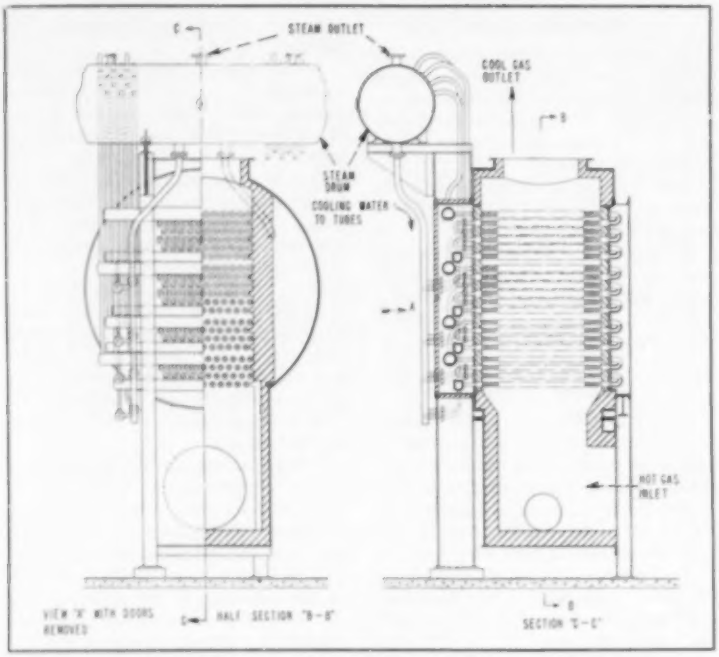
Meet the Author

MR. BRESS

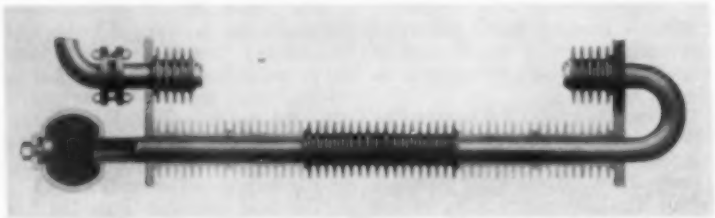
Mr. Dellason F. Bress, engineer in Foster Wheeler Corp.'s Process Plants Div., obtained his B.S. in Chemical Engineering at the University of Michigan in 1943. After working a short period at the Houdry Process Corp. in Linwood, Pa., evaluating aviation gasoline crudes, he entered the army, serving two years as an enlisted man in the Combat Engineers.

On leaving the service, he joined Foster Wheeler Corp., where he has worked in the Industrial Div., and is currently in the Process Plants Div. During this period, he obtained his M.S. in Chemical Engineering at New York University via night school, and earned his Professional Engineering license.

Dell and his wife Sophia have three children—two girls and a boy and reside in Garden City, Long Island, N. Y.



WASTE HEAT BOILER receives hot gases at bottom which are cooled by water circulating through the extended area heat transfer tubes. Heat is recovered in form of steam leaving the top of the steam drum.



EXTENDED AREA TUBES increase heat transfer area with cast iron rings on outside surface. Rings, tube plates and connecting header are shown above.

and pumps, and is also available for heating and tracing the molten sulfur lines and storage tank.

The steam generated is usually in excess of the sulfur plant requirements, and may be used for other requirements outside the sulfur plant.

Use of steam-drive auxiliaries has the advantage of making the recovery unit self-contained for continuous operation in event of power failure, or where adequate electrical power is not available.

Foster Wheeler steam generating equipment makes use of cast iron, covered, steel tube heating surfaces. Such material is not only corrosion resistant but permits a maximum of heating surface in a minimum of space. The use of extended surfaces —as shown in photo—also allows wide flexibility in the unit for plants sized for from 30 to 400 tons per day sulfur production. Its use also has the following advantages peculiar to water-tube steam generating units, boilers and water heaters:

1—No maximum pressure limitation.
2—Accessibility to heating surfaces, internally and externally.
3—Flexibility in physical design and arrangements.
4—Easy field replacement or modification of design.

The Foster Wheeler design uses the waste heat boiler—see drawing above —as the initial gas cooling step (with economizer—not illustrated—to feed water heating) following the reaction furnace.

All heat recovery equipment is constructed from carbon steel material, together with the cast iron heat transfer elements. To prevent sulfiding in these units, where the gas temperature may be above 600°F., the casing shell of the heat transfer equipment is maintained at a low temperature by proper application of internal refractory lining. Tube temperatures are kept below 600°F. by maintaining the proper circulation of water through them.

There is no sulfur condensation in the economizers, since the minimum water temperature entering is above 200°F.

Sulfur Wash Towers

Final cooling and condensation of the sulfur product from the gas leaving the economizers is carried out in wash towers. In these towers, recirculated liquid sulfur is used to cool the gas and scrub out any sulfur mist which might form. There are two towers, one for the furnace conversion step, and a second for the catalytic conversion step.

The towers are made from carbon steel and their design, similar to water cooling towers, contains an internal fill of carbon steel. Ample gas and sulfur passages are provided as insurance against plugging with solid sulfur.

A sump at the bottom of each wash tower collects the sulfur which is cooled and recirculated. The sulfur make leaves the sump through a gravity overflow, going to storage.

Sulfur circulating pumps for the wash towers are of the submerged type, eliminating shaft packing maintenance.

All Foster Wheeler plants installed to date have included the wash towers which have given good performance. Another method of carrying out the final cooling and condensation of sulfur is to use additional extended surface heat transfer elements in which tempered cooling water is circulated. Such a procedure would eliminate the sulfur recirculation system and decrease the size of the scrubbing section.

CATALYTIC CONVERSION

Although the furnace reaction is essentially a reduction of hydrogen sulfide with oxygen to produce sulfur and water, it is believed that an equilibrium in the reaction between hydrogen sulfide and sulfur dioxide to produce sulfur and water actually determines furnace conversion.

Therefore, in order to effect maximum conversion, the Foster Wheeler process cools and condenses the sulfur product formed in the furnace before passing the gas to a catalytic converter in which the hydrogen sulfide and sulfur dioxide are reacted at a lower temperature. With this procedure, it has been found that variations in furnace efficiency are compensated for in the conversion step, insuring maximum and constant efficiency with a minimum of control by the plant operator.

The catalytic conversion reaction is exothermic, and should therefore be carried out at the lowest practical temperature to obtain maximum conversion. This temperature has been found to be the lowest one which will not cause condensation of sulfur in the catalyst bed (poisoning the catalyst), or in the duct from the converter to the second economizer-condenser (wash tower). Since the temperature of the feed to the converter is low as it leaves the first wash tower, it must be reheated before entering the catalytic converter.

Reheating prior to the catalytic converter is carried out in a vertical shell-and-tube heater mounted on top of a combustion chamber. Natural gas or other auxiliary fuel is burned in the fire box and the hot combustion gases pass upward through the tubes of the exchanger, heating the converter feed flowing counter-currently in the shell.

The heater is fabricated from carbon steel and the combustion chamber is also of steel construction, with a refractory lining.

Combustion control instruments are furnished so that the temperature of the gas to the converter may be varied to obtain maximum efficiency.

The catalytic converter is constructed entirely of carbon steel with an internal refractory lining to protect against sulfiding. The catalyst is supported on a perforated cast iron or carbon steel plate which rests on brick piers. The entire arrangement permits easy removal and replacement.

A layer of crushed refractory is placed above the catalyst to serve as a filter to remove free carbon which might be formed by excessive hydrocarbons in the feed gas. This arrangement has been found advantageous in protecting the catalyst since only the crushed fire brick need be replaced. Provision is made for removal of fire brick from the outside, so that it is not necessary for operator to enter the confined gassy reactor interior.

The catalyst itself is arranged in a relatively thin bed having a large diameter. This type of bed is typical for highly exothermic reactions, and insures a maximum of lateral mixing, which is desirable. The thin bed minimizes the gas pressure drop so as not to increase the requirements on the combustion air blower.

STORAGE

The product sulfur in the sumps at the bases of the two wash towers overflows by gravity to a below-grade storage tank. Ample tank capacity is provided to care for variations in operation or demands for the sale of molten sulfur.

Storage in the molten form provides flexibility for liquid sales, or for transporting the sulfur to dry storage. During plant startup, the storage tank is used to hold the molten sulfur required for the initial filling of the wash towers.

The storage tanks are most conveniently made of reinforced concrete and are brick lined throughout. Steel construction is subject to sulfiding and corrosion, with the further disadvantage that the corrosion products when using steel are flammable.

The tank is covered with a concrete roof, and where steel is used for roof supports, the steel parts are concrete lined. The roof may also be made from aluminum which is not subject to attack by liquid sulfur.

Piping carrying sulfur to the storage tank and from the storage tank to a dry storage pile is constructed of carbon steel with steam jacketing. Special consideration is given to flanged connections in order to prevent freezing and plugging at these points. Valves are of a special plug type. The piping from the storage tank is designed so that it is free draining after the tank is emptied.

The sulfur removal pump in the storage tank is of the submerged tank type, arranged for free draining by shutting down the pump after use before any of the valves in the sulfur lines are closed.

Sulfur can be shipped molten, or in the solid form. To obtain a solid product, the molten sulfur from the run-down (storage) tank is pumped into a large form on the open ground to a depth of about 2 in. for each pumping. After allowing one pumping to solidify, the process is repeated as often as desired, until sulfur slabs are as much as 10 ft. thick.

Storage of sulfur in the open during all types of weather does not lessen its purity, since the sulfur is relatively inert.

To load the solidified sulfur onto railroad box cars for shipment, the sulfur slab can be broken up by dynamite blasts, or by "thumping" with the shovel bucket with which the sulfur is being loaded.

Recently, a new method for flaking sulfur has been reported. The molten sulfur is fed onto a stainless steel conveyor belt supported so that it floats on the surface of water in a tank. The sulfur is thus solidified and comes off the end of the belt in flakes which are further reduced in size before shipment.

EFFLUENT GAS

In a properly designed plant, the effluent gas leaving the second wash tower will contain only small amounts of sulfur dioxide and hydrogen sulfide, with a large amount of reaction product water vapor.

Whether the effluent gas must be treated or not depends on the local laws and physical location of the plant. One problem which arises is caused by the large amount of water vapor in the gas. Upon hitting the atmosphere, the water condenses and forms a dense exhaust cloud, which may have a tendency to drop to a low level and cause a nuisance problem in surrounding residential areas.

The usual procedure for handling a local problem of this nature is to install a tall stack with an incinerator furnace at the bottom which burns auxiliary fuel to heat the gas and to oxidize the residual hydrogen sulfide. The hot gases from this stack are, of course, more easily dispersed in the upper atmosphere.

Such a procedure is fairly expensive due to the considerable amount of fuel to be burned in order to heat the water vapor and nitrogen. In addition, it is necessary to heat the gas to a temperature higher than is required for good dispersal to insure that the very small amount of hydrogen sulfide in the gas is entirely oxidized.

Recently, catalytic treatment of exhaust gas streams from various plants has become popular, and it appears that units of this type may be used for sulfur plant effluents. One type, which employs a platinum-containing catalyst, was investigated. Preliminary calculations indicate that a substantial saving in fuel may be made using such a unit to oxidize the hydrogen sulfide while heating the gas to aid in its dispersal.

New Equipment for the Plant

56 items of particular interest to engineers who design, build and operate petrochemical units

EQUIPMENT manufacturers are constantly designing new models and revising old models in an effort to be of greater service to the processing industries. From among these new or redesigned equipment and material items, the Editors of PETROLEUM PROCESSING have selected a few of the more outstanding developments which have come to their attention, and present them in the following pages for your information. For more data concerning these items circle the key number on the Reader Service card facing p. 1473 in this issue.

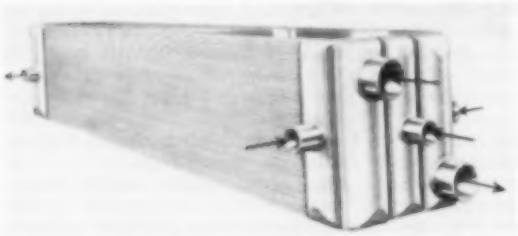
HEAT TRANSFER EQUIPMENT

Courtesy of The Griscom-Russel Co.

Dual-Gage, Long Exchanger Tubes

. . . **for shell-and-tube types** with fixed or floating tube sheets, or U-bend types. Tube ends are increased up to four gages internally to allow for return bend corrosion or erosion. For U-bend exchangers, thickened tube center portions allow for stretching during bending. Tubes available in standard copper-base alloys and sizes. Bridgeport Brass Co., Bridgeport 2, Conn.

Circle No. **1** *on Reply Card*

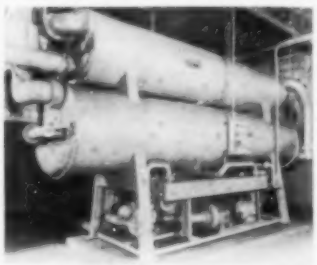


Brazed Aluminum Heat Exchangers

. . . **for low temperature applications** such as gas separation processes. Working pressures are up to 600 psi. Exchanger construction is by flux-bath brazing layers of corrugated aluminum sheets between flat plates to form individual passages for fluid flow. One cubic foot of brazed aluminum core has up to 450 sq. ft. of heat transfer surface. The Trane Co., LaCrosse, Wisc.

Circle No. **2** *on Reply Card*

Absorption Refrigeration Units



. . . **produce chilled water or gasses** from hot fluids or low pressure steam (12 psig), and have no major moving parts. Available in 11 sizes from 100 to 700 tons, they operate automatically from full to zero load with little efficiency loss. Will also operate from heat sources such as natural gas. Carrier Corp., 300 S. Geddes St., Syracuse 1, N. Y.

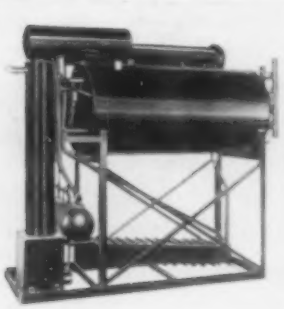
Circle No. **3** *on Reply Card*

Integral-Finned Exchanger Tubing

. . . **for use in heat exchange and refrigeration** applications to give high heat transfer efficiencies and compact installations. The "Trufin" exchanger tubes are available in a wide range of sizes and alloys, copper, aluminum and welded steel tubing. Wolvering Tube, Div. of Calumet & Hecla, Inc., 1850 Guardian Bldg., Detroit 26, Mich.

Circle No. **4** *on Reply Card*

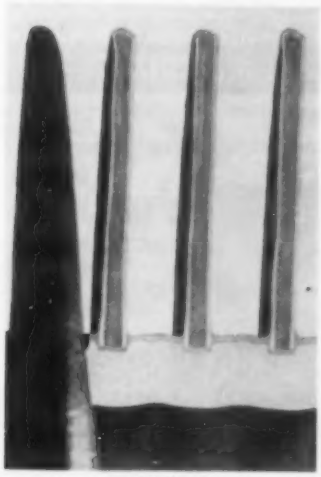
Steam-Operated Water Chiller



. . . for process cooling or air conditioning, uses water refrigerant and lithium bromide absorbent. Can be installed for single or multiple unit operation. Applications include extraction of condensate from casing-head gas at gas field compressor plants, cooling oil to precipitate wax, etc. The chiller is a package unit ready to operate. Servel, Inc., Evansville 20, Ind.

Circle No. **5** *on Reply Card*

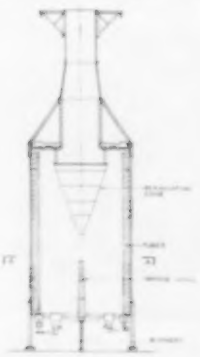
Copper-Stainless Finned Tubing



. . . for fired heater convection sections or waste heat utilization uses helical fins made of copper with a bonded stainless steel cladding to combine the high thermal conductivity of copper and the corrosion resistance of stainless steel for high temperature gas to liquid service, or gas to high pressure gas service in the process industries. The Griscom-Russell Co., Massillon, Ohio.

Circle No. **6** *on Reply Card*

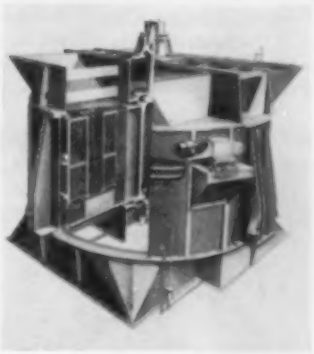
Multi-Coil Furnace



. . . combines two or more heating services in one circular vertical setting by the use of several separate heating coils in the same unit. The drawing shows the radiant section of a furnace with 3 separate heating coils for duties of 18, 12 and 5 million Btu/hr. Heating elements are located around the walls and are separated by bridgewalls. The unit may have a convection section for steam generation in addition to the radiant section. Petro-Chem Development Co., Inc., 122 E. 42nd St., New York 17, N Y.

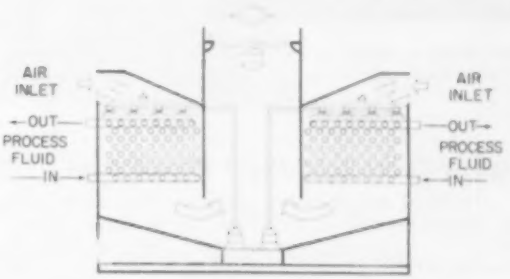
Circle No. **7** *on Reply Card*

Combustion Air Preheating



. . . by heat recovery from stack gases in a preheater using slowly rotating metal surfaces for heat exchange. Recommended as a replacement for convection tubes, the preheater is said to reduce fuel requirements 1% for every 45-50° F. of air preheat required for fuel-fired combustion units. The Air Preheater Corp., 60 E. 42nd St., New York 17, N. Y.

Circle No. **8** *on Reply Card*

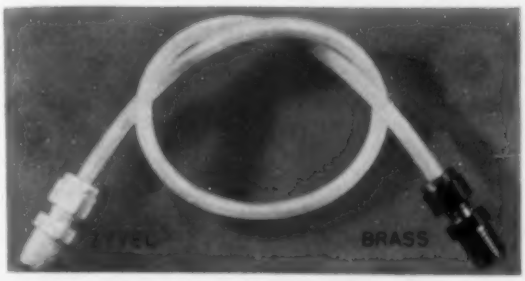


Evaporative Cooling Exchanger

. . . cools by water evaporation with temperature control by use of outdoor air. About 1000 Btu of heat is transferred for every pound of water evaporated. Heating, instead of cooling, can be by steam or electrical heaters in the spray water tank. The unit is assembled on the installation site. Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y.

Circle No. **9** *on Reply Card*

PIPING, FITTINGS



Polyamide Resin Tube Fittings

. . . for use with plastic tubing in applications where corrosion is a problem. Made of du Pont "Zytel," the fittings

include elbows, tees, reducers and adapters. Two ferrules and a threaded chuck grasp the tube, forming leakproof joints without the need for sleeves or inserts. No special tools are needed for installation. Crawford Fitting Co., 884 E. 104th St., Cleveland 10, Ohio.

Circle No. **10** *on Reply Card*

Manifold Welding Fitting

. . . has integral extruded welding outlets. A recent change in the Code for Pressure Piping paved the way for the manifold welding fittings which can be used for piping system fabrication where branch outlets are appreciably smaller than the run pipe. The fitting is "tailored" to individual jobs in all commercial metals and alloys. Tube Turns, 224 E. Broadway, Louisville 1, Ky.

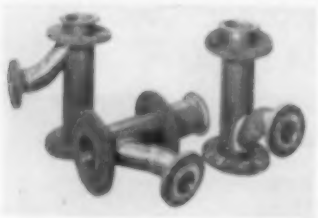
Circle No. **11** *on Reply Card*

Lightweight, Semi-Rigid Plastic Pipe

. . . is strong and corrosion-resistant. Made of a blend of styrene-acrylonitrile copolymer and a nitrile rubber, "Semi Rigid Kralastic" comes for 75, 100 and 150 psi. working pressure grades in 20-ft. lengths, with sizes from ½ through 6 inches. The piping is easy to cut and join with solvent welded fittings. Republic Steel, Pipe Div., Republic Bldg., Cleveland 1, Ohio.

Circle No. **12** *on Reply Card*

Aluminum-Bronze Pipe and Fittings



. . . resist the corrosion of sulphuric acid sludge. Used to replace lead-lined steel piping and fittings, "Ampco Grade 8" 4-in. lines give the same capacity of lined 6-in. lines due to elimination of lead lining. Welding is by shielded gas, inert arc, or shielded gas metallic arc processes using "Ampco-Trode 10" wire. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, Wisc.

Circle No. **13** *on Reply Card*

Polyvinyl Chloride Piping and Fittings

. . . successfully resist acid corrosion at Globe Chemical Co. tank farms handling 77-99% H_2SO_4, 61.4% HNO_3, 75-85% H_3PO_4, 37-38.5% muriatic acid and 99.5% glacial acetic acid at atmospheric temperatures and below 100 psi. The piping, from 1¼ to 2 in., and screwed fittings are injection molded of unplasticized polyvinyl chloride by Tube Turns Plastics, Inc., and distributed by Maintenance Engrg. Corp., Houston, Texas.

Circle No. **14** *on Reply Card*

Process Headers and Manifolds

. . . of cast carbon and carbon-moly steels for the petrochemical plant of Standard Oil Co. of Ohio at Lima, Ohio. The manifolds incorporated one and two hole terminal fittings as an integral casting. The manifolds were then assembled with pipe to elbows, flanges, and caps to make complete manifold assemblies. The Ohio Steel Foundry Co., Lima, Ohio.

Circle No. **15** *on Reply Card*

INSULATION MATERIALS

Universal Pipe and Block Insulation

. . . for all temperatures from 100 to 1600° F. "All-temp" is a moisture-resistant, non-brittle combination of special inorganic silicas and asbestos fibers with little high - temperature shrinkage. Available in blocks either flat (6 or 12-in. wide x 36-in. long) or preformed (6-in. wide x 36-in. long), it can be applied in sections or segments. The Philip Carey Mfg. Co., Lockland, Cincinnati 15, Ohio.

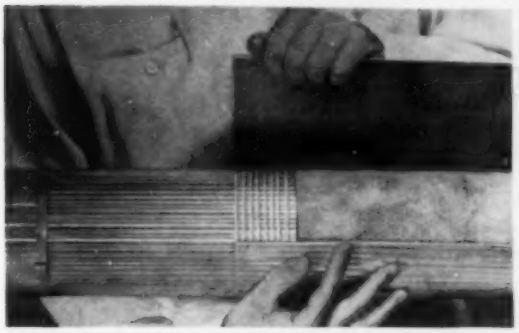
Circle No. **16** *on Reply Card*

Cellular Glass Block Insulation

. . . is fireproof, acid-resistant and moistureproof. Block rigidity and strength allows building unsupported walls which need no finish coating. The block is cellular with an integral, denser glass surface. Installation is by

dipping in hot asphalt or cold adhesive and pressing into place. Sizes are 12 x 18 in., 3 or 4 in. thick. Pittsburgh Corning Corp., 1 Gateway Center, Pittsburgh 22, Pa.

Circle No. **17** *on Reply Card*



Weather-Sealing Aluminum Jacketing

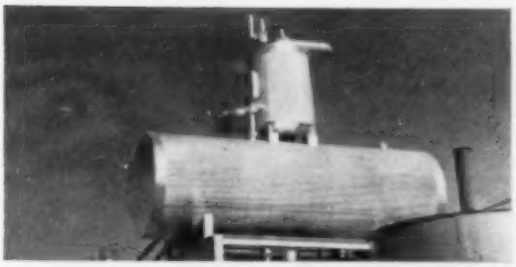
. . . is easily installed, light, and strong. Primarily for weather-proofing outdoor piping insulation, the positive weather seal is obtained by a series of eight circumferential ribs rolled into the underlapping edge of the jacketing. The jacketing conforms to the contour of the lines and requires no special installation equipment. Childers Mfg. Co., Houston, Texas.

Circle No. **18** *on Reply Card*

Resin-Bonded Glass Fiber Insulation

. . . has factory-applied vapor-barrier jacket to prevent condensation. The jacket has five plys, with two layers of 0.001 aluminum foil enclosed in Kraft paper. "Fiberglass White Dual Temperature Pipe Insulation" comes in 1, 1½, 2 and 2½-in. thicknesses to fit standard pipe sizes to 33 in. and copper tubing to 6 in., for use from —120 to +250° F. Owens-Corning Fiberglas Corp., Toledo 1, Ohio.

Circle No. **19** *on Reply Card*



Metal-Jacketed Blanket Insulation

. . . gives low-cost, long-life weather protection for temperatures up to 1200° F. "Copr-fibre Blanket" consists of lead base, felted mineral fibers fastened to a corrugated vapor-sealing aluminum jacket. Painting is not needed for the jacket, and the assembly absorbs equipment expansion or contraction without cracking. Forty Eight Insulations, Inc., P. O. Box 472, Aurora, Ill.

Circle No. **20** *on Reply Card*

PUMPS, BLOWERS, COMPRESSORS

Corrosion-Resistant Plastic Blower

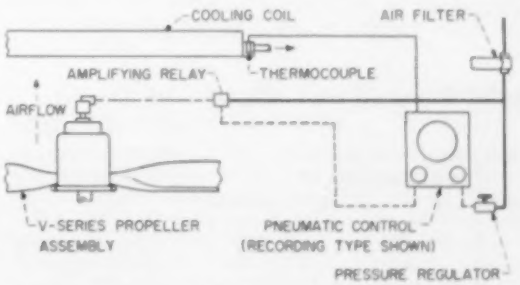
. . . handles corrosive fumes of mineral oils and derivatives, aliphatic compounds, alkalies, most strong mineral acids, etc., with temperatures of 40-140° F. All parts contacting the gas are of solid, polished polyvinyl chloride. The centrifugal blowers are supplied in sizes from 9½ to 27 in. and may be installed vertically or horizontally. Industrial Plastic Fabricators Inc., Endicott St., Norwood, Mass.

Circle No. **21** *on Reply Card*

Two-Stage Air or Gas Compressor

. . . for high-pressure, high-capacity compression. Capable of boosting pressures from 15 up to 50 psig., 125 psig. discharges are possible with appropriate inlet pressures. The "Standardaire" intercooled compressor is available in 100 to 4000 cfm. capacities and 15 to 600 hp. Blower construction assures air-free compressed gas delivery. Read Standard Corp., 901 Richland Ave., York, Pa.

Circle No. **22** *on Reply Card*

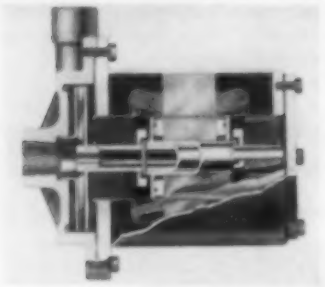


Controllable Pitch Fan Blade

. . . maintains temperatures within ± 1½° F. by adjusting blade pitch settings automatically with temperature controls. Fans are available in 120, 132 and 144-in. diameters with molded plastic blades, and 96, 103 and 120-in. with cast aluminum alloy blades. Air deliveries range from 0 to 400,000 cfm. at ¼-in. static pressure. Hartzell Propeller Fan Co., Piqua, Ohio.

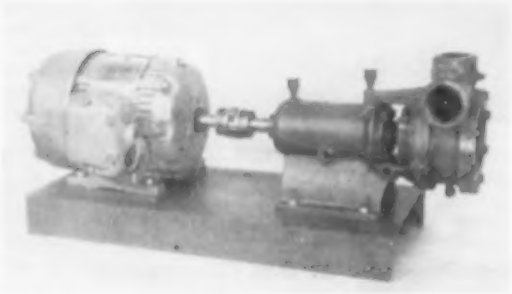
Circle No. **23** *on Reply Card*

Seal-less Centrifugal Pumps



. . . are leakproof and corrosion-resistant. "Model S" pump parts can be clad with titanium, zirconium, the Hastelloy series metals, Monel, Carpenter 20 and other stainless steels. Capacities to 170 gpm. and heads to 150 ft. are available in the 1/3 to 3 hp. models, for use up to 350° F. and 150 psi. Chempump Corp., Station H., 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Circle No. **24** *on Reply Card*

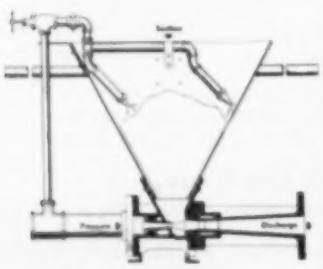


Cold Process Turbine Pump

. . . handles liquid ammonia, LPG, and chemicals. The "Type Z4" pump uses a mechanical seal subject to section pressure only and is available in bronze fitted, all iron, all bronze, or special alloy construction. Capacities available are from 5 to 60 gpm. for heads from 0 to 350 ft. New York Air Brake Co., Aurora Pump Co. Div., Aurora, Ill.

Circle No. **25** *on Reply Card*

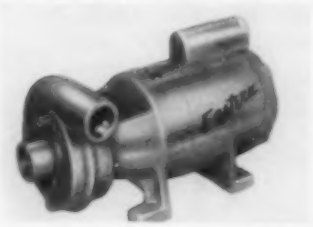
Solid Pumped and Mixed with Liquid



. . . using hopper eductor. Pressure water washes solids into suction chamber where the eductor entrains the solids in a pressure water stream, mixing and pumping the solids through the discharge line. The "254 Hopper Type Eductor" can be made of corrosion and erosion-proof materials to fit the specific applications. Schutte and Koerting Co., Cornwells Heights, Bucks County, Pa.

Circle No. **26** *on Reply Card*

Close-Coupled Centrifugal Pumps

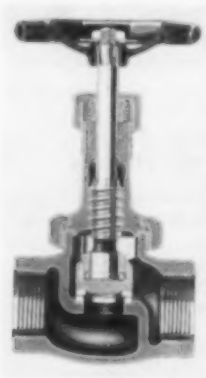


. . . for small chemical pumping demands are available in cast iron, bronze, stainless steel, Monel and Hastelloy C, to accommodate the materials being pumped. Six standard models range from ⅛ to ¾ hp. with capacities up to 70 gpm. and pressures up to 65 psi. Eastern Industries, Inc., 100 Skiff St., Hamden 14, Conn.

Circle No. **27** *on Reply Card*

VALVES, ACCESSORIES

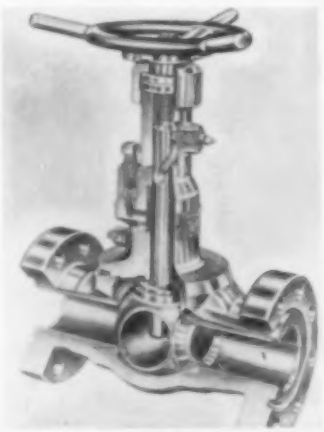
Bronze Globe Valves for Throttling



. . . reduce premature wear and failure. The "LQ 600", for non-corrosive installations, uses "Brinalloy" seating alloy which, while not surface-hardened, is hard all the way through to resist wear. These seats do not require replacement, regrinding or renewing. Also featured is a flat-valve seat, made possible by Brinalloy. Ordinary materials have been impractical for flat seat throttling designs due to rapid failure caused by wire drawing. Lunkenheimer Co., Cincinnati 14, O.

Circle No. **28** *on Reply Card*

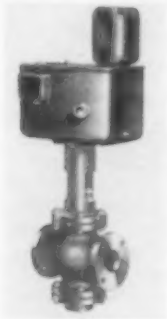
Valves with Teflon Base Packings



. . . handle various chemicals such as ammonia, alcohols, amines, water, CO_2, air, H_2, N_2, Cl_2, O_2, LPG, aromatic hydrocarbons, petroleum solvents, etc. Valve seats can be made of Teflon, laminated stainless steel, asbestos sheet or Buna-N bond. Metal to metal sealing is also provided for fire protection. Orbit Valve Co., Box 699, Tulsa, Okla.

Circle No. **29** *on Reply Card*

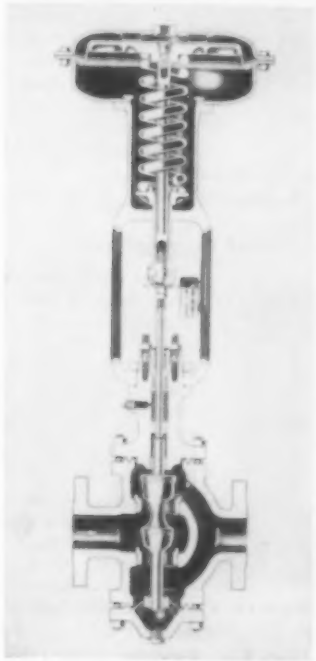
Electro-Hydraulic Valve Actuator



. . . is for electronic controllers. The actuator is a self-contained unit including control valve, hydraulic power source and proportional positioning mechanism. The valve moves faster than 1 in./sec. Thrusts greater than 600 lb. can be handled, with up to 2-in. strokes presently available. Signal current is applied to a high-resistance coil (3000 ohms or more) which moves in a magnetic field. Askania Regulator Company, 240 East Ontario St., Chicago 11, Ill.

Circle No. **30** *on Reply Card*

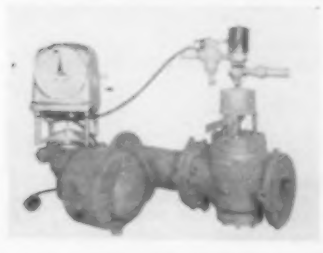
Diaphragm Motor Valves



. . . have direct or reverse action construction. A bolted-clamp stem connection allows stem adjustments of 50% total travel in either direction. Diaphragm casings are of drawn steel. Diaphragms are molded Buna-N with nylon inserts. The stuffing box is the bolted clamp type with Teflon packing. The hi-tensile iron yoke is connected to the body by a forged steel hammer lug nut. Top work is removable without disturbing stuffing box. The indicator is calibrated in % of valve travel. Fisher Governor Co., Marshalltown, Ia.

Circle No. **31** *on Reply Card*

Automatic Liquid Metering System



. . . can batch either light or heavy liquids. The "Fluidometer System" consists of a control unit, meter and valve assembled in one unit or placed remotely. Featuring an automatic reset for repetitive operations, the system is accurate for both high and low viscosity fluids from gallon to tank car quantities. Hetherington & Berner Inc., 700 Kentucky Ave., Indianapolis 7, Ind.

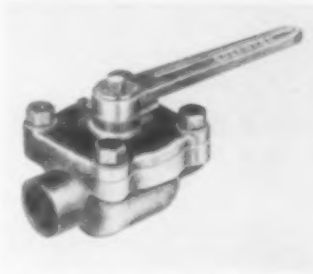
Circle No. **32** *on Reply Card*

Bellows Relief Valve

. . . protects against corrosion, fouling and surges due to low back-pressure. The "Style JB Protecto Seal Bellows Relief Valve" uses a 2-ply stainless steel Bellows with moving parts guided and held in alignment by a single member. The valve is adaptable to installations requiring a closed venting system for all relief valves in the plant. Crosby Steam Gage & Valve Co., Wrentham, Mass.

Circle No. **33** *on Reply Card*

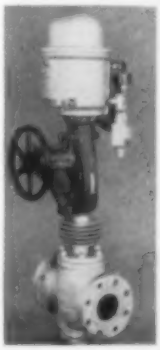
Top Entry Ball Valve



. . . handles oxygen and hazardous liquids as well as water, oil and gas. Seat can be Buna-N, Neoprene, Kel-F, Teflon or Nylon. Made of bronze and available in ½, ¾ and 1-in. sizes, it carries 300 psi. on water, oil and gas, or 400 psi. on LPG. Rockwood Sprinkler Co., 38 Harlow St., Worcester 5, Mass.

Circle No. **34** *on Reply Card*

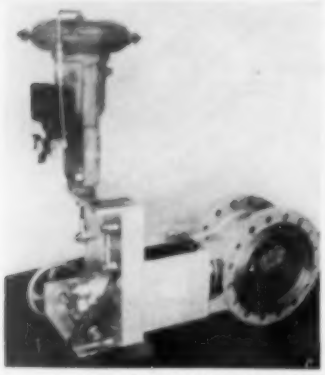
Electro-Hydraulic Operator



. . . for control valves eliminates need for air supply and compressor systems and operates entirely by electrical power to position conventional slip-stem control valves using hydraulic power developed by a self-contained pumping unit supplied by 115 or 230 volt power. The valve operator accepts a 0.5 to 5.0 milliampere direct current signal from transmission and control systems, which can be as much as 30 miles from the control valve operator. Manning, Maxwell & Moore, Inc., Industrial Controls, Stratford, Conn.

Circle No. **35** *on Reply Card*

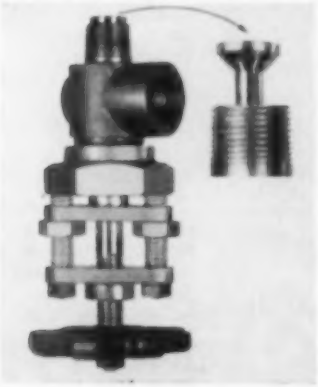
Gas Throttle Butterfly Valve



. . . gives minimum flow restriction and turbulence. The "12 ID" valve pictured has a cast steel body with stainless steel vane and shaft, and is automatically controlled by an air operator with a disc positioner. Maximum flow is 1,740,000 scf/hr. W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn.

Circle No. **36** *on Reply Card*

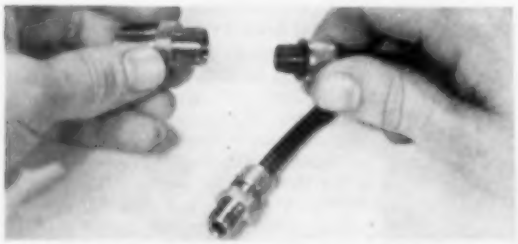
Self-Draining Sample Valve



. . . seats valve stem outside of valve body to keep liquid from remaining in the nipple and valve. The "No. 23" valve is for pressures to 4000 psi. at 100° F. or 1000 psi. at 750° F., and has ¾-in. connections. Materials include carbon steel body, stainless stem and Stellited seat, with special alloys optional. Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Massachusetts.

Circle No. **37** *on Reply Card*

INSTRUMENTS, ACCESSORIES

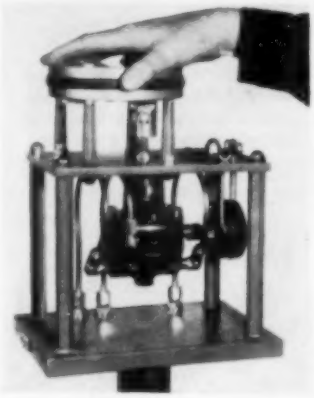


Flareless Instrument Line Fitting

. . . is made of brass for copper or nylon lines. "Intru-lok" is quickly connected without fitting disassembly. Available in all commonly used body shapes in sizes 4 through 16 (for ¼ through 1-in. O.D. tubing), with special nuts (sizes 4 and 6) for use with ¼ and ⅜-in. O.D. soft plastic tubing. Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

Circle No. **38** *on Reply Card*

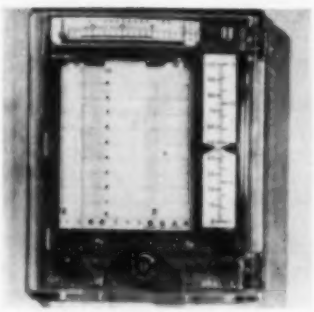
Continuous Gas Sampler



. . . replaces spot sampling methods. The "Arcco-Annubis Model 100-7" accumulates, over 7 days, at a constant rate to give a sample of near 100 psig from a sample source not less than 125 psig. Constant rate of gas pressure increase in the sampler—from 0 to the desired final pressure—gives a continuous gas flow rate into the sampler. American Recording Chart Co., 3113 E. 11th St., Los Angeles 23, Calif.

Circle No. **39** *on Reply Card*

Miniature Recorders and Controllers



. . . are low in cost, easily installed and compact. For control or recording of process variables, such as temperature, pressure, flow and liquid level, they operate on 20 psi. air supply, have true linear calibration, have a quick-connect mounting and require minimum maintenance. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **40** *on Reply Card*

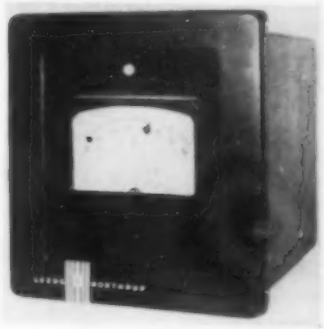
Metal-Ceramic Thermocouple Well

. . . is corrosion-resistant and has fast response. The "LT-1" is resistant to thermal shock, air oxidation, combustion gases, etc., combining thermal conductivity and shock resistance of metal with oxidation and deformation

resistance of ceramics. Wells are available in 12, 18, and 24-in. lengths, and are also available as complete thermocouple assemblies. The Bristol Co., Waterbury 20, Conn.

Circle No. **41** *on Reply Card*

Continuous pH or Redox Readings



. . . are reproducible to 0.02 pH. The automatic, panel mounted indicator provides 0-14 pH range on 0.1 divisions, 0-700 mv. reduction-oxidation range in 5 mv. divisions and 0-1400 in 10 mv. divisions. It is unaffected by voltage surges, electrical pickup and zero drift. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa.

Circle No. **42** *on Reply Card*

Gas Density Balance

. . . uses a null-balance principle. Sensitivity and accuracy are ½% full scale with a 95% response in less than one minute. Ranges of 0.100 total span relative to air from 0 to 2.000 are available. Models are available for continuous or intermittent measurements. Arnold O. Beckman, Inc., 1020 Mission St., South Pasadena, Calif.

Circle No. **43** *on Reply Card*

Direct Reading Flow Rate Meter

. . . provides visual flow rate indication in circulating, lubricating and fueling systems. The "Revere F-8110" weighs 1½ lb., and is designed to cover a flow range of 7 to 70 gph at temperatures of −65 to +160° F. The unit has only one moving part and is accurate to within ± 2% of the specified flow rate and has a low pressure drop. Revere Corp. of America, Wallingford, Conn.

Circle No. **44** *on Reply Card*

Automatic Logging and Scanning Unit

. . . logs and electronically scans up to 200 variables with a single digital printer, or any number of process points using two or more printers. "Panalog 650" prints off-normal values in red. Audio-visual alarms accompany recording of off-normal conditions. All points, or only the off-normal values may be printed, as desired. Panellit, Inc., 7401 N. Hamlin Ave., Skokie, Ill.

Circle No. **45** *on Reply Card*

CONSTRUCTION MATERIALS

Non-Skid Steel Flooring

. . . is made of abrasive impregnated rolled steel. Marketed as "AW Algrip," the flooring combines aluminum oxide grain with rolled steel to give a product which can be sheared, drilled, countersunk, machined and flame cut for installation in chemical plants or refineries. Alan Wood Steel Co., Conshohocken, Pa.

Circle No. **46** *on Reply Card*

Rubber-Containing Concrete Flooring

. . . resists alkalis and mild acids, is waterproof and takes loads to 2500 psi. without cracking. "Laticrete" comes in two parts — liquid rubber and a special powdered cement for on-the-job mixing. It is applied like ordinary concrete and adheres to concrete, metal and glass. Naugatuck Chemical Div., U. S. Rubber Co., Rockefeller Center, New York 20, N. Y.

Circle No. **47** *on Reply Card*

Chemically Nickel-Plated Steel

. . . reduces corrosion and product contamination. The plating process, "Alcoplate," can be applied to inexpensive base metals to give better corrosion resistance than

either pure or wrought nickel. Plating adheres well, can be used to give uniform coatings on intricate shapes and has zero porosity. Alco Products, Inc., Schenectady 5, N. Y.

Circle No. **48** *on Reply Card*

Clad Metals by High Vacuum Brazing

. . . **have corrosion resistance and strength** with uniform cladding thicknesses. "Hortonclad" is made by cladding the backing plate using a brazing material heated under high vacuum. Meeting ASME Boiler and API—ASME Unfired Pressure Vessel Codes, the plate is available in nickel-base alloy and other claddings. Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago 4, Ill.

Circle No. **49** *on Reply Card*

Chlorinated Rubber Coatings

. . . **are unaffected by corrosives** such as acids, alkalis, salts, moisture, fungus growth, and petroleum products. "Parlon" paints can be applied to either concrete or steel surfaces, and can be formulated to resist oxidizing agents, bleaches, cleaning compounds and vapors and fumes. Hercules Powder Co., Wilmington 99, Del.

Circle No. **50** *on Reply Card*

MISCELLANEOUS

Data Processing Services

. . . **with newest types of electronic machines** is the first of a series of "Centers" to be located throughout the U. S. Equipment includes the IBM 650, 701 and 702 and smaller medium-sized electronic calculators. These facilities are available to industry on an hourly rental basis from $100 for the 650 up to $445 for the 702 computer shown in the photograph. International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.

Circle No. **51** *on Reply Card*

Thickened Chemical Cleaning Solvent

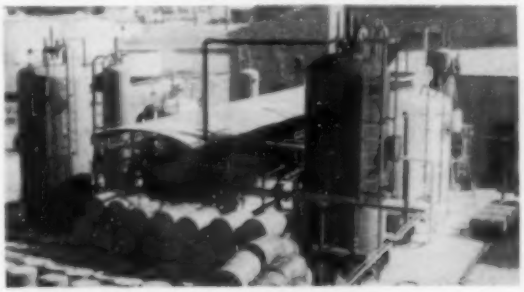
. . . **combines jetting and chemical action** in a remotely operated, hydraulically driven jet sprayer called a "Zingger," which uses a high speed worm gear to swing dual nozzles in a repeating spherical motion. In tank cleaning, seams, bolts, corners, etc., are exposed to the jet's cutting force and the chemical's cleaning action. Dowell, Inc., P. O. Box 536, Tulsa, Okla.

Circle No. **52** *on Reply Card*

Corrosion and Fouling Inhibitor

. . . **also prevents hydrogen blistering** by eliminating generation of atomic hydrogen, which is caused by active corrosion. "Nalco 161" is a polar, high molecular weight, organic liquid with detergent and corrosion inhibiting properties usable in systems with a pH as low as 0.6. May be used in towers, exchangers, lines, etc., with a 5 to 20 ppm. dosage. National Aluminate Corp., 6216 W. 66th Pl., Chicago 38, Ill.

Circle No. **53** *on Reply Card*

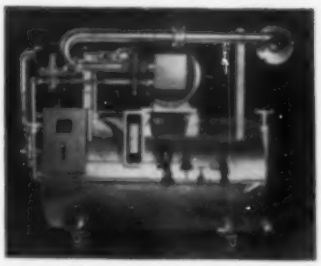


Oxyalkylation Facility Services

. . . **for securing non-ionic surface active agents** commercially unavailable. Substantially anhydrous materials with a reactive hydrogen atom are susceptible to oxyalkylation. From 50 to 2000 gal. may be processed at all customary temperatures and pressures by reaction with ethylene oxide, propylene oxide, or a mixture of the two. Visco Products Co., P. O. Box 6826, Houston 5, Texas.

Circle No. **54** *on Reply Card*

Nitrogen and Inert Gas Generators



. . . **redesigned to reduce maintenance costs.** In addition, the unit has been made more compact — requiring less floor space— and has had operating costs reduced by a special automatic turndown control system and a interconnecting control for operation in conjunction with compressors, as well as other improvements. Gas Atmospheres, Inc., 20011 Westlake Rd., Cleveland 16, Ohio.

Circle No. **55** *on Reply Card*

Rust and Corrosion Inhibitor

. . . **for metal tanks and bunkers** used to transport petrochemicals and hydrocarbons. "Korid Metal Conditioner," applied in water solution to hold or tank walls, is said to prevent color deterioration of stored methanol, butynol, xylol, toluol and gasoline. The conditioner is said not to affect the stored liquid, and to protect the tank vapor space. Tretolite Co. Div., Petrolite Corp., St. Louis 9, Mo.

Circle No. **56** *on Reply Card*

Your regular What's New listing of equipment, materials, services and trade literature starts on p. 1473.

Who's in Petrochemicals—1955

Fourth annual study shows 187 companies with 327 plants—operating, building, or planned

Here are the highlights of the petrochemical industry in the United States and Canada today, as revealed by PETROLEUM PROCESSING's fourth annual petrochemical plant survey:

- There are 187 companies and 327 petrochemical plants in the U. S. and Canada now in operation, under construction, or being planned.
- Of the 187 companies, 63 are petroleum companies or their subsidiaries, 45 are petrochemical firms, 72 are chemical, and 7 are joint ventures between petroleum and chemical firms.
- Total investment already made by the industry in the 289 plants now in operation is estimated at over $3-billion on the basis of reported figures. Other sources, however, place it at close to $4-billion.
- An additional 38 totally new plants are under construction or planned, representing an estimated new investment of approximately $400-million.
- Expansion-wise, there are 58 projects for the addition of new units to existing plants, with an estimated investment of about $500-million. Total additional investment now in the works for new and expanded plants is therefore close to $1-billion.
- There are 24 new companies now reported in the petrochemical industry since the 1954 directory was published. Some of these are brand new companies established within the past 12 months; others are existing firms that have decided to get into petrochemicals.

Details on each of these plants is given in the directory below, based on information furnished by the individual companies or compiled from previously published sources.

A new feature added to the 1955 directory is an alphabetical products index, which starts on p. 1427. This index lists all the petrochemicals reported in the directory and the key numbers of the plants which are reported to be making them.

Petrochemical Plants in the United States

ALLIED CHEMICAL & DYE CORP. 1
Baton Rouge, La.
Remarks: Listed in 1954 as proposed plant, but company says product not made from petroleum hydrocarbons.

ALLIED CHEMICAL & DYE CORP.
(Barrett Division) 2
Frankford, Penna.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Phenol – 20,000,000 lb/yr
Personnel: Thomas Lee, acting mgr; J. C. Shea, superintendent; J. T. Keating, chief engr.

ALLIED CHEMICAL & DYE CORP.
(General Chemical Division) 3
El Segundo, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfuric acid – 150,000 ton/yr
Personnel: J. V. Claes, mgr; W. B. Yarborough, chief engineer
Remarks: Refinery gases are supplied by Standard Oil Co. of California.

ALLIED CHEMICAL & DYE CORP.
(General Chemical Division) 4
Richmond, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfuric acid – 100,000 ton/yr
Personnel: T. H. Compton, manager; D. L. Hicken, superintendent; W. B. Yarborough, chief engineer
Remarks: Refinery gases supplied by Standard Oil Co. of California. An expansion to double acid capacity is scheduled for completion in October, 1955.

ALLIED CHEMICAL & DYE CORP.
(National Aniline Division) 5
Buffalo, N. Y.
Hydrocarbon raw materials:
Kerosine
Products and output:
Synthetic detergents
Personnel: C. C. Coakley, manager; B. R. MacKinnon, superintendent; H. W. Busch, chief engineer

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division) 6
La Platte, Neb.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 75,000 ton/yr
Urea – 120,000 ton/yr
Personnel: R. L. Riggs, manager; V. A. Perringer, superintendent; J. H. Fitzpatrick, chief engineer
Remarks: Plans to double ammonia capacity, announced in August, 1954, are contingent on obtaining the necessary natural gas.

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division) 7
South Point, Ohio
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 320,000 ton/yr
Urea – 80,000 ton/yr
Methanol – 53,500 ton/yr
Formaldehyde – 42,500 ton-yr (100%)
Personnel: C. W. Bahrt, Jr., manager; C. E. Brandon, Jr., superintendent; J. H. Broadbent, chief engineer

WHO MAKES WHAT PETROCHEMICALS?

For your convenience in locating manufacturers of specific products, turn to the index on p. 1427. Products are listed alphabetically with reference numbers corresponding to numbers with each plant item in this directory.

ALLIED CHEMICAL & DYE CORP.
(Nitrogen Division) 8
Orange, Texas
Hydrocarbon raw materials:
Ethylene
Products and output
Ethylene oxide – 12,000 ton/yr
Ethylene glycol – 16,000 ton/yr
Ethanolamine
Personnel: E. L. Ray, manager; H. Lanier, superintendent; J. E. Hollis, Jr., chief engineer

ALLIED CHEMICAL & DYE CORP
(Nitrogen Division) 9
Hopewell, Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 400,000 ton/yr
Personnel: F. A. Ernst, manager; S. G. McKenzie, superintendent; F. H. Van Benthuysen, chief engineer

ALLIED CHEMICAL & DYE CORP.
(Semet-Solvay Division) 10
Buffalo, N. Y.
Remarks: From 1954 list. Company reports now considered part of Tonawanda operations (see below).

ALLIED CHEMICAL & DYE CORP
(Semet-Solvay Division) 11
Tonawanda, N. Y.
Hydrocarbon raw materials:
Ethylene (from fuel oil)
Fuel oil
Products and output:
Polyethylenes – 20,000,000 lb/yr
Butadiene – 8,000,000 lb/yr
Propylene – 10,000,000 lb/yr
Personnel: W. J. Wixson, superintendent; Anthony T. Koehne, chief engineer
Remarks: Crude light oils are recovered and refined at another location.

ALLIED CHEMICAL & DYE CORP. (Solvay Process Division) — 12
Moundsville, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Methyl chloride
Methylene chloride
Chloroform
Carbon tetrachloride
Total – 11,500 ton/yr
Personnel: W. E. Dugan, manager; R. Largent, chief engineer

ALOX CORP. — 13
Niagara Falls, N. Y.
Hydrocarbon raw materials:
Oxygenated petroleum hydrocarbons
Products and output:
Rust preventive, oil and cutting oil additives
Total – 12,500,000 lb/yr
Personnel: C. A. Weltman, manager; D. W. Andrus, superintendent

AMERICAN CYANAMID CO. — 14
Avondale, La.
Approximate investment: $50,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 109,000 ton/yr
Acetylene
Hydrocyanic acid
Acrylonitrile
Personnel: R. L. Hock, manager; J. J. O'Leary, superintendent; V. E. Macdowell, chief engineer
Remarks: A $7,840,000 plant for mono-methylstyrene is expected to be completed in late spring, 1956.

AMERICAN OIL CO. — 15
Texas City, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Plasticizers
Polymers and resins
Benzene
Toluene
Xylene
Methyl mercaptan – 5,000,000 lb/yr
Personnel: B. F. Babin, manager
Remarks: Investment in mercaptan unit was $5,000,000. Company formerly Pan American Refining Corp.; renamed in spring of 1955.

AMERICAN SYNTHETIC RUBBER CORP. — 16
Louisville, Ky.
Approximate investment: $2,340,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S rubber – 44,000 ton/yr
Personnel: R. W. MacFarlane, production manager; F. J. Sackfield, technical superintendent; E. W. Zipfel, plant engineer
Remarks: Former government-owned plant, operated by Kentucky Synthetic Rubber Corp., sold to American Synthetic Rubber Corp. during recent rubber plant disposal program.

AMMONIA CHEMICAL CORP. OF CALIFORNIA — 17
Oleander, Calif. (nr. Merced)
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 36,000 ton/yr
Remarks: New company, holding rapid tax write-off approval since June 1954.

ATLANTIC REFINING CO. — 18
Philadelphia, Penna.
Approximate investment: $5,500,000
Hydrocarbon raw materials:
Natural gas
Petroleum fractions
Refinery gases
Products and output:
Ammonia – 30,000 ton/yr
Synthetic detergents
Sulfuric acid
Personnel: D. T. Shaw, manager

ATLANTIC REFINING CO. — 19
Atreco, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic detergents
Personnel: R. Stewart, manager

ATLAS POWDER CO. — 20
Location undecided
Approximate investment: $6,750,000
Products and output:
Ammonia
Remarks: Certificate of necessity granted. Plant still in planning stage.

ATLAS PROCESSING CO. — 21
Shreveport, La.
Approximate investment: $4,500,000
Gross value, products: 1954 – $4,496,000
1955 – $4,496,000
Hydrocarbon raw materials:
Petroleum naphtha
Products and output:
Benzene – 8,000,000 gal/yr
Personnel: V. B. Chance, president and manager; W. L. Miller, chief engineer

AURORA GASOLINE CO. — 22
Detroit, Mich.
Approximate investment: $250,000
Hydrocarbon raw materials:
Refinery streams
Products and output:
Sulfur – 9,000 ton/yr
Personnel: L. A. Curran, general manager
Remarks: Completion date: November, 1955

AURORA GASOLINE CO. — 23
Muskegon, Mich.
Personnel: R. E. McCarty, superintendent
Remarks: Old Dutch Refining Co. Plant, it has been taken over by Aurora. UOP Platforming unit of 1500 b/d capacity making motor fuel stocks only at present.

BAKELITE CO. — 24
Marietta, Ohio
Approximate investment: $2,722,000
Products and output:
Styrene
Remarks: Plant under construction. Completion expected Jan. 1956. Actual raw materials may include BOTH petroleum and non-petroleum sources.

BARIUM REDUCTION CORP. — 25
So. Charleston, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon bisulfide
Hydrogen sulfide
Personnel: L. Preisman, technical director

BARNHART HYDROCARBON CORP. — 26
Big Lake, Texas
Approximate investment: $700,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks
Personnel: J. M. Sappington, vice president
Remarks: Formerly operated as Witco Hydrocarbon Corp. Witco Chemical Co. markets the carbon black.

BREA CHEMICALS, INC. — 27
Brawley, Calif.
Approximate investment: $250,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonium phosphate
Remarks: Plant is still in planning stage.

BREA CHEMICALS, INC. — 28
Brea, Calif.
Approximate investment: $16,250,00
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 85,775 ton/yr
Nitric acid
Ammonium nitrate – 90,000 ton/yr
Ammonium phosphate – 17,000 ton/yr
Dry ice and liquid carbon dioxide – 25,550 ton/yr
Personnel: R. S. Ogilvie, manager
Remarks: Ammonium nitrate plant, at estimated cost of $3,000,000, is scheduled for completion this summer. This plant is owned by Ammoniaco Corp., leased to Brea for operation.

BREA CHEMICALS, INC. — 29
Fresno, Calif.
Approximate investment: $100,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonium phosphate – 17,000 ton/yr

BRYTON CHEMICAL CO. — 30
Trainer, Penna.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Oil-soluble sulfonates
Personnel: E. W. Carlson, manager; Lyle Walker, superintendent; D. A. Wilkie, chief engineer
Remarks: Plant is owned by Continental Oil Co., operated by Bryton.

CABOT CARBON CO. — 31
Franklin, La.
Hydrocarbon raw materials:
Petroleum residues
Natural gas
Products and output:
Carbon blacks – 157,000,000 lb/yr
Personnel: H. S. Ayres, manager
Remarks: Capacity shown above includes 33,000,000 lb/yr capacity now under construction.

CABOT CARBON CO. — 32
Ville Platte, La.
Hydrocarbon raw materials:
Petroleum residues
Natural gas
Products and output:
Furnace blacks – 109,000,000 lb/yr
Personnel: R. T. Bowen, manager

CABOT CARBON CO. — 33
Hobbs, N. Mex.
Remarks: This carbon black plant idle since January, 1955.

CABOT CARBON CO. — 34
Guymon, Okla.
Remarks: This carbon black plant idle since October, 1952.

CABOT CARBON CO. — 35
Big Spring, Texas
Hydrocarbon raw materials:
Petroleum residues
Products and output:
Oil furnace blacks – 60,000,000 lb/yr
Personnel: A. R. Davenport, manager

CABOT CARBON CO. — 36
Kermit, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks – 28,000,000 lb/yr
Personnel: A. L. Dickson, Manager

CABOT CARBON CO. — 37
Kingsmill, Texas
Remarks: Shutdown plant, now dismantled.

CABOT CARBON CO. — 38
Pampa, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Furnace blacks – 51,000,000 lb/yr
Personnel: E. J. O'Brient, manager

CABOT CARBON CO. — 39
Skellytown, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks for rubber, ink, and paint
Total – 27,000,000 lb/yr
Personnel: W. L. Marshall, manager, Plant A; J. M. Brown, manager, Plant B.

CABOT CARBON CO. — 40
Stinnett, Texas
Remarks: Shutdown plant, now dismantled.

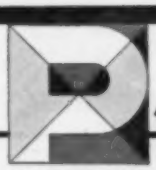
CABOT CARBON CO. — 41
Bickett, Texas
Remarks: Idle since July, 1953.

CALIFORNIA SPRAY CHEMICALS CO. — 42
Richmond, Calif.
Hydrocarbon raw materials:
Petroleum bases
Products and output:
N-trichloromethylmercapto-4-cyclohexene-1,2-dicarboximide
N-butyl,2,4-dichlorophenoxyacetate
Isopropyl,2,4-dichlorophenoxyacetate
2,4-dichlorophenoxy-acetic acid, dimethylamine salt
Tetrahydrofurfuryl,2,4,5-trichlorophenoxyacetate
Tetraethyl pyrophosphate
Ethylene glycol mono-oleate
Personnel: E. W. Cannon, vice president
Remarks: Subsidiary of Standard Oil Co. of California. A $16,000,000, 300 ton/day fertilizer plant is scheduled for completion in mid-1956.

CALUMET NITROGEN PRODUCTS CO. — 43
Hammond, Ind.
Approximate investment: $9,000,000

(Continued on next page)

■ PLANTS



Petrochemicals 1955 REPORT

(Colonet Nitrogen Products – Cont.)
Hydrocarbon raw materials:
Reformer off-gas
Products and output:
Anhydrous ammonia – 109,500 ton/yr
Nitrogen solutions – 36,500 ton/yr
Remarks: By-product hydrogen to be obtained from Std. Oil (Ind.) refinery at Whiting, Ind. and Sinclair, East Chicago, Ind. refineries. Indiana Std. to operate. New company is jointly owned (50% Indiana Std. & 50% Sinclair). Plant scheduled for completion mid-1956.

CARBIDE & CARBON CHEMICALS CO. 44
Torrance, Calif.
Approximate investment: $36,323,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Polyethylene – 60,000,000 lb/yr
Ethylene glycol – 10,000,000 gal/yr
Ethylene oxide
Personnel: C. N. Rucker, superintendent
Remarks: Ethylene oxide facilities scheduled for completion early in 1956.

CARBIDE & CARBON CHEMICALS CO. 45
Whiting, Ind.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene glycol
Isopropanol
Acetic acid and anhydride
Personnel: W. J. Bagby, superintendent

CARBIDE & CARBON CHEMICALS CO. 46
Seadrift, Texas
Approximate investment: $66,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ethylene glycol
Polyethylene
Ethylene oxide
Butadiene
Personnel: C. M. Blair, Jr., superintendent

CARBIDE & CARBON CHEMICALS CO. 47
Texas City, Texas
Hydrocarbon raw materials:
Natural & refinery gases
Products and output:
Polyethylene – 60,000,000 lb/yr
Ethylene-amines
Alcohols
Glycols
Acetone
Acetic acid and anhydride
Vinyl resins
Hydrogen cyanide
Acetylene
Personnel: E. J. Fox, superintendent

CARBIDE & CARBON CHEMICALS CO. 48
Institute, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ethanol
Butanol
2-ethylhexanol
Glycols
Acetic acid and anhydride
Maleic anhydride
Styrene
Polyethylene
Plasticizers
Personnel: C. H. Atwood, superintendent

CARBIDE & CARBON CHEMICALS CO. 49
So. Charleston, W. Va.
Hydrocarbon raw materials:
Natural and refinery gases
Products and output:
Alcohols
Glycols
Ethers and oxides
Esters
Ketones
Aldehydes
Acetals
Anhydrides
Vinyl resins
Polyethylene
Plasticizers
Wetting agents
Personnel: R. D. Glenn, superintendent

CARBON BLACKS, INC. 50
Rayville, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black

CARLISLE CHEMICAL WORKS, INC. 51
Reading, Ohio
Remarks: Company reports raw materials definitely not petroleum hydrocarbons now.

CARTHAGE HYDROCOL, INC. 52
(See Hidalgo Chemical Co.)

CELANESE CORP. OF AMERICA 53
Bishop, Texas
Hydrocarbon raw materials:
Propane and butane
Products and output:
Methanol
N-propanol
Formaldehyde
Paraformaldehyde
Acetaldehyde
Acetic acid
Acetone
Butylene glycol
Propylene oxide and glycol
Dipropylene glycol
Trioxane
Iso- and N-butanol
Iso-butyl, n-butyl, and n-propyl acetate
Methylal
Ethylene glycol diacetate
Personnel: E. T. Lindsey, manager

CELANESE CORP. OF AMERICA 54
Pampa, Texas
Hydrocarbon raw materials:
Propane and butane
Products and output:
Acetaldehyde
Acetic acid and anhydride
Vinyl acetate – 5,000,000 lb/yr
Propionic and butyric acid
Methanol and solvents
Methyl ethyl ketone
Personnel: J. F. Frick, manager
Remarks: Vinyl acetate output was doubled in June.

CELANESE CORP. OF AMERICA 55
Gallipolis Ferry, W. Va.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Tricresyl phosphate
Plasticizers
Remarks: New plant on 412-acre site. Completion date, April, 1956. C. F. Braun & Co. has contract. Raw materials to come from Bishop and Pampa, Texas. Some coal-tar hydrocarbons also to be used.

CHEMSTRAND CORP. 56
Pensacola, Fla.
Hydrocarbon raw materials:
Natural gas
Cyclohexane
Products and output:
Acrylonitrile
Personnel: R. G. Henninghaus, vice president; Fred G. Gronemeyer, manager

CHILLICOTHE PETROCHEMICALS, INC. 57
Chillicothe, Texas
Approximate investment: $8,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 68,400 ton/yr
Personnel: R. A. Sitta, president
Remarks: In planning stage. Company incorporated spring 1954. Financing being arranged. Firm replaces Chillicothe Chemical Mfg. Co., now dissolved, which had planned $17,000,000 plant.

CITIES SERVICE REFINING CORP. 58
Lake Charles, La.
(see Petroleum Chemicals, Inc., who bought butadiene plant.)

CITIES SERVICE OIL CO. (Del.) 59
Oklahoma City, Okla.
Hydrocarbon raw materials:
Natural gas
Products and output:
Methanol
Acetaldehyde
Formaldehyde
Acetone
Remarks: Crude mixtures only, shipped to Tallant for purification.

CITIES SERVICE OIL CO. (Del.) 60
Tallant, Okla.
Gross value, products: 1954 – $749,440
1955 – $562,000
Hydrocarbon raw materials:
Butane
Products and output:
Methanol – 450,000 gal/yr
Acetaldehyde – 450,000 gal/yr
Formaldehyde – 800,000 gal/yr
Acetone – 80,000 gal/yr
Personnel: L. T. Botts, superintendent

COLUMBIA RIVER CHEMICALS, INC. 61
Pasco, Wash.
Approximate investment: $16,000,000
Hydrocarbon raw materials:
Bunker C fuel oil
Products and output:
Anhydrous ammonia – 57,600 ton/yr
Ammonium sulfate – 50,400 ton/yr
Urea – 39,600 ton/yr
Remarks: New company. Plant to operate on fuel oil until natural gas becomes available. Design and construction by Fluor Corp. Completion not set.

COLUMBIA-SOUTHERN CHEMICAL CORP. 62
Barberton, Ohio
Hydrocarbon raw materials:
Propylene
Products and output:
Perchloroethylene
Personnel: W. S. Straub, manager

COLUMBIA-SOUTHERN CHEMICAL CORP. 63
Natrium, W. Va.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Chlorinated benzenes
Personnel: C. E. Wolf, manager

COLUMBIAN CARBON CO. 64
El Dorado, Ark.
Approximate investment: $2,600,000
Gross value, products: 1954 – $3,000,000
1955 – $3,500,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black – 70,000,000 lb/yr
Personnel: B. H. Cobb, supervisor

COLUMBIAN CARBON CO. 65
Hickok, Kans.
Approximate investment: $1,900,000
Gross value, products: 1954 – $1,200,000
1955 – $1,500,000
Electrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black – 31,200,000 lb/yr
Personnel: J. W. Buchanan, superintendent

COLUMBIAN CARBON CO. 66
Eola, La.
Approximate investment: $1,400,000
Gross value, products: 1954 – $1,400,000
1955 – $1,500,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black – 38,500,000 lb/yr

COLUMBIAN CARBON CO. 67
Franklin, La.
Approximate investment: $3,500,000
Gross value, products: 1955 – $1,300,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Furnace black – 42,000,000 lb/yr
Personnel: J. S. Norris, Jr., supervisor
Remarks: New plant, completed Nov., 1954, and is operating at 50% of capacity.

COLUMBIAN CARBON CO. 68
Hancock, La.
Remarks: An experimental pilot plant, operating on natural gas to produce furnace blacks.

COLUMBIAN CARBON CO. 69
Eunice, N. Mex.
Approximate investment: $1,500,000
Gross value, products: 1954 – $2,300,000
1955 – $2,400,000
Hydrocarbon raw materials:
Natural and casinghead gas
Products and output:
Channel black – 24,500,000 lb/yr
Personnel: C. E. Thompson, superintendent

COLUMBIAN CARBON CO. 70
Coltexo, Texas
Approximate investment: $680,000
Gross value, products: 1954 – $1,100,000
1955 – $1,280,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel black – 4,260,000 lb/yr
Personnel: Bernard Johnson, superintendent, main plant; Howard Johnson, superintendent, Plant 2

COLUMBIAN CARBON CO. 71
Conroe, Texas
Approximate investment: $3,100,000
Gross value, products: 1954 – $3,800,000
1955 – $3,400,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black – 71,750,000 lb/yr
Personnel: C. C. May, supervisor

COLUMBIAN CARBON CO. 72
Corpus Christi, Texas
Approximate investment: $547,000
Gross value, products: 1954 – $575,000
1955 – $524,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Channel black – 7,300,000 lb/yr
Personnel: J. A. Aulds, superintendent

COLUMBIAN CARBON CO. 73
Fortune, Texas
Approximate investment: $980,000
Gross value, products: 1954 – $930,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black – 15,000,000 lb/yr
Remarks: Plant idle since March 25, 1955.

COLUMBIAN CARBON CO. 74
Kingsmill, Texas
Remarks: Channel black plant, idle since July, 1954.

COLUMBIAN CARBON CO. 75
Lefors, Texas
Approximate investment: $1,300,000
Gross value, products: 1954 – $2,103,000
1955 – $2,494,700
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Channel black – 25,000,000 lb/yr
Personnel: N. C. Jordan, supervisor

COLUMBIAN CARBON CO. 76
Seagraves, Texas
Approximate investment: $1,600,000
Gross value, products: 1954 – $1,000,000
1955 – $1,300,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Furnace black – 49,000,000 lb/yr
Personnel: R. Fowler, supervisor

COLUMBIAN CARBON CO. 77
Seminole, Texas
Approximate investment: $2,300,000
Gross value, products: 1954 – $2,000,000
1955 – $2,000,000
Hydrocarbon raw materials:
Natural gas and/or petroleum fractions
Products and output:
Channel black – 27,000,000 lb/yr
Sulfur
Personnel: J. E. Earhart, supervisor

COLUMBIAN CARBON CO. 78
Sunray, Texas
Remarks: Channel black plant, idle since Aug., 1953

COLUMBIAN CARBON CO. 79
Sweeney, Texas
Approximate investment: $628,000
Gross value, products: 1954 – $435,000
1955 – $550,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black – 1,092,000 lb/yr
Personnel: E. Johnson, superintendent

COMMERCIAL SOLVENTS CORP. 80
Peoria, Ill.
Hydrocarbon raw materials:
Natural gas
Products and output:
Nitroparaffins
Personnel: T. M. Walton, manager

COMMERCIAL SOLVENTS CORP. 81
Sterlington, La.
Approximate investment: $45,000,000
Hydrocarbon raw materials:
Natural gas and propane
Products and output:
Ammonia – 135,000 ton/yr
Methanol
Ammonium nitrate solutions
Solid ammonium nitrate fertilizer
Nitroparaffin – 10,000,000 lb/yr
Personnel: J. E. Wheeler, general manager, production, petrochemicals division

CONSOLIDATED CARBON CORP. OF ILL. 82
Remarks: No further plans. See Lynn Carbon Black Co.

CONSOLIDATED CHEMICAL INDUSTRIES, INC. 83
Baton Rouge, La.
Hydrocarbon raw materials:
Acid sludge
Products and output:
Sulfuric acid – 140,000 ton/yr
Personnel: W. J. Daspit, manager

CONSOLIDATED CHEMICAL INDUSTRIES, INC. 84
Baytown, Texas
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Acid sludge
Products and output:
Sulfuric acid – 140,000 ton/yr
Personnel: Z. L. Evans, manager

CONSOLIDATED CHEMICAL INDUSTRIES, INC. 85
Houston, Texas
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Acid sludge
Products and output:
Sulfuric acid – 140,000 ton/yr
Personnel: O. D. Massey, manager

CONTINENTAL BLACKS, INC. 86
Westlake, La.
Hydrocarbon raw materials:
Refractory refinery cycle stock
Products and output:
Oil furnace blacks
Personnel: V. W. Fergus, general manager

CONTINENTAL BLACKS, INC. 87
Ponca City, Okla.
Approximate investment: $2,750,000
Hydrocarbon raw materials:
Refractory refinery cycle stock
Products and output:
Oil furnace blacks – 40,000,000 lb/yr
Personnel: Frank H. Forbes, general manager

CONTINENTAL CARBON CO. 88
Eunice, New Mex.
Hydrocarbon raw materials:
Natural gas
Products and outputs:
Channel black
Personnel: R. A. Dosher, general manager

CONTINENTAL CARBON CO. 89
Sunray, Texas
Hydrocarbon raw materials:
Dry natural gas
Refractory refinery cycle stock
Products and output:
Carbon blacks
Personnel: O. Middlebrooks, general manager

CONTINENTAL OIL CO. 90
Chicago, Ill.
Hydrocarbon raw materials:
Dodecylbenzene
Products and output:
Water soluble sulfonates
Personnel: K. R. Gerhart, general manager
Remarks: Formerly Stepan Chemical Co. plant.

CONTINENTAL OIL CO. 91
Lake Charles, La.
Approximate investment: $2,700,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene
Toluene
Dodecene
Personnel: J. M. Jones, general manager
Remarks: Dodecene and benzene are delivered to the Continental petrochemical plant at Baltimore, Md., where dodecylbenzene is produced for the detergent industry.

CONTINENTAL OIL CO. 92
Baltimore, Md.
Hydrocarbon raw materials:
Benzene
Propylene tetramer
Products and output:
Synthetic detergent base stock
Personnel: W. O. Miller, general manager

CONTINENTAL OIL CO. 93
Ponca City, Okla.
Approximate investment: $7,500,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene and other aromatic mixtures (as reformate) – 3850 b/d
Personnel: C. D. Hull, general manager
Remarks: New platformer of 3850 b/d capacity completed in April, 1954.

CONTINENTAL OIL BLACK CO. 94
Remarks: See Continental Blacks, Inc.

COOPERATIVE FARM CHEMICALS ASSN 95
Lawrence, Kans.
Approximate investment: $16,000,000
Gross value, products: 1954 – $546,765
1955 – $7,605,200
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 13,200 ton/yr
Ammonium nitrate – 83,000 ton/yr
Nitrogen solutions – 13,200 ton/yr
Personnel: R. R. Zurbuchen, general manager; J. M. Wadsworth, superintendent; Anthony Fornelli, chief engineer
Remarks: Company is an affiliate of Consumers Cooperative Assn., Kansas City, Mo.

COPOLYMER RUBBER & CHEMICAL CORP. 96
Baton Rouge, La.
Approximate investment: $10,000,000
Gross value, products: 1954 – $21,751,000
1955 – $29,998,000
Hydrocarbon raw materials:
Butylene
Styrene
Products and output:
Butadiene – 23,000 ton/yr
GR-S synthetic rubber – 49,000 ton/yr
Personnel: Col. G. M. Hulings, exec. vice president; T. B. Crowell, superintendent; C. M. McKay, chief engineer
Remarks: Company's two plants acquired from government Rubber Facilities Disposal Commission, April, 1955. Copolymer's seven member firms: Armstrong Rubber Co., Dayton Rubber Co., Gates Rubber Co., Mansfield Tire & Rubber Co., Sears, Roebuck & Co., and Seiberling Rubber Co.

COSDEN PETROLEUM CORP. 97
Big Spring, Texas
Approximate investment: $3,000,000
Gross value, products: 1954 – $4,000,000
1955 – $4,500,000
Hydrocarbon raw materials:
Aromatics from Platformer
Petroleum fractions
Cycle stock
Products and output:
Benzene
Toluene
Xylene and paraxylene
Polyisobutylenes
"Kenflex" resins
Personnel: Dan M. Krausse, general manager; George Grimes, superintendent; E. B. McCormick, chief engineer; W. K. Jackson, director, organic chemical division

DEERE & CO. (Grand River Chemical Division) 98
Pryor, Okla.
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 65,880 ton/yr
Urea – 90,000 ton/yr
Personnel: L. A. Rowland, vice president and general manager; W. W. Yeandle, works manager; J. Purnell, superintendent; R. B. Ady, chief engineer

DELHI TAYLOR OIL CORP. 99
Corpus Christi, Texas
Hydrocarbon raw materials:
Crude oil and distillate
Products and output:
Aromatics
Personnel: F. A. Reneau, superintendent
Remarks: Refinery not running presently for production of petrochemicals. Aromatic being used in motor fuel.

DELTA GAS CHEMICAL CORP. 100
Buras, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Nitrogenous fertilizers
Remarks: Certificate of necessity for $8,892,000 issued in March, 1952, has expired. John Pottharst, a New Orleans, La., electric utilities man, had original certificate and is reportedly still interested in the project.

DIAMOND ALKALI CO.
(Chlorinated Products Division) 101
Newark, N. J.
Approximate investment: $1,250,000

(Continued on next page)

(Diamond Alkali – Cont.)
Gross value, products: 1954 – $4,700,000
1955 – $4,600,000

Hydrocarbon raw materials:
Benzene
Products and output:
Hexachloro benzene
Chloral
Pesticides
Miticides
Personnel: John Burton, manager

DIAMOND ALKALI CO. 102
(Chlorinated Products Division)
Painesville, Ohio
Approximate investment: $4,450,000
Gross value, products: 1954 – $3,925,000
1955 – $5,000,000
Hydrocarbon raw materials:
Paraffin wax
Products and output:
Chlorinated paraffin, liquid and resinous
Carbon tetrachloride
Anhydrous hydrogen chloride
Personnel: R. C. Rahn, manager

DIAMOND ALKALI CO. 103
(Chlorinated Products Division)
Deer Park, Houston, Texas
Approximate investment: $4,850,000
Gross value, products: 1954 – $5,075,000
1955 – $5,125,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Vinyl chloride
Ethylene dichloride
Perchlorethylene
Paraffin solvent
By-product hydrogen chloride
Poly vinyl chloride resin
Personnel: E. S. Weiner, manager

DIAMOND ALKALI CO. 104
(Chlorinated Products Division)
Greens Bayou, Houston, Texas
Approximate investment: $1,760,000
Gross value, products: 1954 – $1,750,000
1955 – $3,000,000
Hydrocarbon raw materials:
Benzene
Products and output:
Benzene hexachloride
Lindane trichloro benzene
Other pesticides
Personnel: R. J. Kohl, manager

DIAMOND ALKALI CO. 105
(Chlorinated Products Division)
Belle, W. Va.
Approximate investment: $1,420,000
Gross value, products: 1954 – $1,725,000
1955 – $2,200,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Methyl chloride
Methylene chloride
Chloroform
Muriatic acid
Personnel: R. L. Muelman, manager

DOW CHEMICAL CO. 106
Gardena, Calif.
Remarks: Sold by government to Shell. See Shell Chemical Co., Gardena, Calif.

DOW CHEMICAL CO. 107
Pittsburg, Calif.
Hydrocarbon raw materials:
Natural gas
Products and output:
Methylene chloride
Methyl chloride
Chloroform
Carbon tetrachloride
Perchloroethylene
Personnel: M. F. Ohman, manager of operations

DOW CHEMICAL CO. 108
Torrance, Calif.
Hydrocarbon raw materials:
Styrene
Products and output:
Polystyrene
Personnel: Daniel W. Ryan, general manager

DOW CHEMICAL CO. 109
Allyn's Point, Conn.
Hydrocarbon raw materials:
Styrene
Products and output:
Polystyrene
Personnel: K. E. Stober, manager

DOW CHEMICAL CO. 110
Midland, Mich.
Hydrocarbon raw materials:
Ethylene
Propylene
Benzene
Products and output:
Styrene
Butadiene
Alpha methyl styrene
Ethylene glycol
Ethylbenzene
Ethyl chloride
Ethylene dibromide
Diethyl benzene
Divinyl benzene
Ethylene dichloride
Dichloroethylether
Ethylene oxide
Mono-, di-, and tri-ethanolamine
Ethylene diamine
Isopropyl benzene
Isopropyl chloride
Propylene glycol
Propylene oxide
Propylene dichloride
Isopropanolamines
Polyglycols
Polyglycol ethers
Polyvinylidene chloride
Ethylcellulose
Methyl cellulose
Polyvinyl chloride
Vinyl toluene
Styrene-butadiene latex – 55,000,000 lb/yr
Personnel: W. H. Schuette, general manager

DOW CHEMICAL CO. (Texas Division) 111
Freeport and Velasco, Texas
Hydrocarbon raw materials:
Butadiene
Methane (natural gas)
Ethylene and propylene
Benzene
Products and output:
Styrene
Methyl chloride
Ethyl chloride
Ethylene dichloride
Vinyl chloride
Carbon tetrachloride
Chloroform
Ethylene glycol
Diethylene glycol
Triethylene glycol
Tetraethylene glycol
Propylene glycol
Perchloroethylene
Trichloroethylene
Dichlorethyl ether
Dichlorisopropyl ether
Ethylene oxide
Propylene oxide
Latex
Methyl chloroform
Methylene chloride
Polyglycol
Propylene dichloride
Styrene oxide
Toluene
Vinylidene chloride
Ammonia – 31,000 ton/yr
Butadiene
Personnel: A. P. Beutel, general manager
Remarks: Glycerol and polyethylene plants scheduled for operation later this year. Cost reported to be estimated at $20,000,000. Glycerol plant capacity to be 36,000,000 lb/yr.

E. I. DU PONT DE NEMOURS & CO. 112
Antioch, Calif.
Products and output:
Anti-knock fluid (TEL)
Fluorinated hydrocarbons
Remarks: Completion is scheduled for end of 1956.

E. I. DU PONT DE NEMOURS & CO., INC. 113
Memphis, Tenn.
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen cyanide
Personnel: T. D. Bell, manager

E. I. DU PONT DE NEMOURS & CO., INC. 114
Beaumont, Texas
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Methanol mercaptan
Products and output:
Methionine
Personnel: H. C. Bailey, manager

E. I. DU PONT DE NEMOURS & CO., INC. 115
La Porte, Texas
Hydrocarbon raw materials:
Benzene
Products and output:
Benzene hexachloride
Methylamines
Dimethyl formamide
Carbonate fungicides
Remarks: Benzene hexachloride plant was not operated in 1954.

E. I. DU PONT DE NEMOURS & CO., INC. 116
Orange, Texas
Hydrocarbon raw materials:
Natural gas
Propane
Ethylene
Benzene
Cyclohexane
Products and output:
Nylon intermediates (adipic acid)
Hexamethylene
Diamine
Methanol
Polyethylene – 100,000,000 lb/yr
Personnel: D. B. Campbell, manager

E. I. DU PONT DE NEMOURS & CO., INC. 117
Victoria, Texas
Hydrocarbon raw materials:
Natural gas
Butadiene
Products and output:
Adiponitrile
Personnel: W. T. Shattuck, manager

EASTERN STATES CHEMICAL CORP. 118
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene and espesol – 2,000,000 bbl/yr
Aromatic and aliphatic solvents
Personnel: M. A. Bomer, assistant manager; H. H. Nicoll, superintendent; H. M. Martin, chief engineer
Remarks: Subsidiary of Eastern States Petroleum Co.

THOMAS A. EDISON CO 119
Bloomfield, N. J.
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen
Remarks: Hydrogen is produced by a Girdler Corp. "Hygirtol" catalytic steam-reforming unit. Hydrogen is not sold but used as a raw matefial in iron purification.

EQUITABLE GAS CO. 120
Maytown, Ky.
Remarks: Now Kentucky Hydrocarbon Co., but does not make petrochemicals.

ESCAMBIA CHEMICAL CORP. 121
Pensacola, Fla.
Approximate investment: $30,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 91,250 ton/yr
Nitric acid – 80,300 ton/yr
Ammonium nitrate – 110,000 ton/yr
Nitrogenous fertilizers – 73,000 ton/yr
Polyvinyl chloride – 15,000 ton/yr
Acetylene
Personnel: D. J. Stark, general manager; J. M. Gafford, superintendent, polyvinyl plant; A. J. Bruno, Jr., chief engineer
Remarks: Company was organized in October, 1954 by Electric Bond & Share Co., N. Y., United Gas Corp., Shreveport, La., National Research Corp., Cambridge, Mass.

ESSO STANDARD OIL CO. 122
Baton Rouge, La.
Hydrocarbon raw materials:
Natural gas
Petroleum gas and liquid fractions
Products and output:
Ethyl alcohol
Isopropyl alcohol
Iso-octyl alcohol
Decyl alcohol
Tridecyl alcohol
Ethyl ether
Isopropyl ether
Isobutylene
Tetrapropylene
Tripropylene
Butadiene
Isoprene-dicyclopentadiene
Benzene-petroleum resins
Aromatic tars
Butyl rubber – 47,000 long ton/yr

(Continued on next page)

(Esso Standard Oil – Cont.)
Personnel: M. J. Voorhies, general manager
Remarks: Butyl rubber facilities purchased from government during recent disposal to private industry for $14,857,000.

ESSO STANDARD OIL CO. 123
Linden, N. J.
Hydrocarbon raw materials:
Petroleum gases and liquid fractions
Products and output:
Isopropyl alcohol
Secondary butyl alcohol
Acetone
Methyl ethyl ketone
Isopropyl acetate
Secondary butyl acetate
Isobutylene
Polyisobutylene
Lube oil additives
Naphthenic acids
Personnel: G. R. Murrell, superintendent

ETHYL CORP. 124
Baton Rouge, La.
Hydrocarbon raw materials:
Ethane
Ethylene
Propane
Benzene
Products and output:
Ethyl chloride
Ethylene di-bromide
Tetraethyl lead
Benzene hexachloride
Lindane
Personnel: R. M. Clothier, general manager
Remarks: Company received a fast write-off approval in May, 1955, for a $4,000,000 chemical "intermediates" plant.

ETHYL CORP. 125
Houston, Texas
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethyl chloride
Ethylene dichloride
Anti-knock compound
Personnel: G. O. Hayes, manager

ETHYL-DOW CHEMICAL CO. 126
Freeport, Texas
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylene dibromide
Personnel: V. A. Thorpe, general manager

FIRESTONE PLASTICS CO. 127
Pottstown, Penna.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Polybutadiene-acrylonitrile type acyclic elastomers
Polybutadiene-styrene type acyclic elastomers
Personnel: B. D. Handley

FIRESTONE TIRE & RUBBER CO.
(Synthetic Rubber Division) 128
Lake Charles, La.
Approximate investment: $11,650,000
Gross value, products: 1955 – $50,000,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber – 99,600 ton/yr
Personnel: W. H. Cain, general manager; C. V. Dille, superintendent; C. R. McBride, chief engineer
Remarks: Facilities bought from government during recent disposal of government owned rubber plants to private industry. Expansion plans are under way for $1,200,000 expenditure at both Lake Charles and Akron, Ohio, plants of Firestone.

FIRESTONE TIRE & RUBBER CO.
(Synthetic Rubber Division) 129
Akron, Ohio
Approximate investment: $2,250,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber and latices – 30,000 ton/yr
Personnel: C. A. Hill, division manager
Remarks: Plant acquired during government sale of synthetic rubber facilities for $2,250,000. Company plans to spend $1,200,000 for further expansion at both Akron and Lake Charles, La., plants, representing approximately 30% increase in annual capacity.

FOSTER GRANT CO., INC. 130
Baton Rouge, La.
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Ethylene
Benzene
Products and output:
Styrene monomer – 24,000,000 lb/yr
Personnel: F. D. Mayfair, manager
Remarks: In operation since April, 1954. Ethylene from Esso Standard Oil Co., benzene from open market. Company plans to expand production to 50,000,000 lb/yr.

FREEPORT SULPHUR CO. 131
Westville, N. J.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur – 12,775 ton/yr
Personnel: E. F. Fay, manager

GENERAL PETROLEUM CORP. 132
Torrance, Calif.
Hydrocarbon raw materials:
Refinery wastes
Products and output:
Ammonium sulfate
Personnel: A. E. Thompson, manager

GENERAL TIRE & RUBBER CO. 133
Mogadore, Ohio
Hydrocarbon raw materials:
Styrene
Butadiene
Products and output:
Polybutadiene
Styrene
Vinylpyridine type acyclic elastomers
Rubber base paint – 10,000,000 lb/yr
Personnel: J. A. Kleinhaus, manager
Remarks: Expansion underway in styrene resin facilities. Paint was expanded last year.

GENERAL TIRE AND RUBBER CO. 134
Baytown, Texas
(See United Carbon Co., Baytown, Texas).

GLIDDEN CO. 135
Cleveland, Ohio
Remarks: Glidden has been licensed by Standard Oil Development Co., to conduct research on surface coatings from Standard's "C-Oil", a material derived from butadiene. Project is still very much in the research stage.

GLOBE OIL & REFINING CO. 136
(See Pure Oil Co., Lemont, Ill.)

B. F. GOODRICH CHEMICAL CO. 137
Louisville, Ky.
Hydrocarbon raw materials:
Butadiene
Styrene
Acrylonitrile
Products and output:
Nitrile type synthetic rubber
Personnel: J. L. Nelson, manager
Remarks: Company is expanding synthetic rubber facilities at Louisville at a cost of around $2,500,000, which will double an unannounced capacity for the product. Construction scheduled for completion early 1956.

B. F. GOODRICH CHEMICAL CO. 138
Akron, Ohio
Hydrocarbon raw materials:
Butadiene
Styrene
Acrylonitrile
Products and output:
Nitrile type synthetic rubber
Personnel: F. C. Hands, manager

B. F. GOODRICH CHEMICAL CO. 139
Port Neches, Texas
(See Goodrich-Gulf Chemical Co.)

B. F. GOODRICH CHEMICAL CO. 140
Institute, W. Va.
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber – 122,000 ton/yr
Personnel: J. R. Haas, manager
Remarks: Government-owned plant maintained in standby. Goodrich has standby staff of about 10 men at this plant.

GOODRICH-GULF CHEMICALS, INC. 141
Port Neches, Texas
Approximate investment: $13,000,000
Gross value, products: 1954 – $25,000,000
1955 – $50,000,000
Hydrocarbon raw materials:
Butadiene and styrene
Products and output:
GR-S rubber – 90,000 ton/yr
Personnel: W. R. Bateman, plant manager; E. E. Mitchell, production manager; F. V. Morrison, plant engineer
Remarks: Goodrich-Gulf purchased plant on April 29, 1955 from the government.

GOODRICH-GULF CHEMICALS, INC. 142
Orange, Texas
Remarks: Plans changed. See same company at Port Neches, Texas.

GOODYEAR SYNTHETIC RUBBER CORP. 143
Akron, Ohio
Approximate investment: $2,075,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S synthetic rubber – 15,200 ton/yr
Personnel: R. C. Stell, manager
Remarks: Facilities, formerly government-owned and operated by Goodyear, purchased from government for $2,075,000 at recent disposal. Plans are in a state of flux as to the future.

GOODYEAR SYNTHETIC RUBBER CORP. 144
Houston, Texas
Approximate investment: $11,889,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S rubber – 99,600 ton/yr
Personnel: B. A. Rosinski, general manager
Remarks: Plant, which was formerly government-owned and operated by Goodyear, purchased from government for $11,889,000 at recent disposal. Plans are in a state of flux as to the future.

GOODYEAR TIRE & RUBBER CO. 145
Akron, Ohio
Approximate investment: $1,762,000
Products and output:
High styrene resins
Nitrile type synthetic rubber
Personnel: R. C. Stell, manager
Remarks: Investment value indicated is for styrene facilities only.

GRACE CHEMICAL CO. 146
Woodstock, Tenn.
Approximate investment: $20,000,000
Gross value, products: 1955 – $6,900,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 87,500 ton/yr
Urea – 52,500 ton/yr
Personnel: J. G. Carriere, manager; C. Dougherty, superintendent; L. C. Skinner, chief engineer
Remarks: Grace Chemical is a subsidiary of W. R. Grace & Co. Plant was completed in late 1954.

W. R. GRACE & CO. 147
Location not selected
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Polyethylene
Remarks: New plant to use process and patent rights of Phillips Petroleum Co. under license. Size and location not decided. Planning to be finished early 1956. Construction to be finished in first half of 1957.

GREAT SOUTHERN CHEMICAL CORP. 148
Corpus Christi, Texas
Approximate investment: $10,000,000
Gross value, products: 1954 – $5,500,000
1955 – $6,500,000
Hydrocarbon raw materials:
Distillate gasoline
Butane
Products and output:
Benzene
Toluene – 18,480,000 gal./yr
Xylenes
Butylenes – 7,980,000 gal./yr
Personnel: L. K. Grove, superintendent; C. B. Ham, technical supervisor

GRIFFIN CHEMICAL CO. 149
Richmond, Calif.
Hydrocarbon raw materials:
Crude petroleum sulfonates
Naphthenates
Products and output:
Naphthenic acid
Lube oil additives
Personnel: W. P. Ruedrich, manager; D. L. Watkins, superintendent; W. E. Lawrence, chief engineer

GULF OIL CORP. 150
Philadelphia, Penna.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Propylene
Sulfur – 50,000 ton/yr
Personnel: J. O. Timms
Remarks: Sulfur recovery unit went on stream this year.

GULF OIL CORP. 151
Crane County, Texas (Waddell Plant)
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 7,000 ton/yr
Personnel: T. W. Rhoads, manager

GULF OIL CORP. 152
Port Arthur, Texas
Hydrocarbon raw materials:
Refinery gases
Heptene
Products and output:
Ethylene – 400,000,000 lb/yr
Sulfur – 21,350 ton/yr
Isooctyl alcohol – 9,000,000 lb/yr
Personnel: R. C. Faulkner, manager
Remarks: A second ethylene plant went on stream this year.

HANCOCK CHEMICAL CO. 153
Long Beach, Calif.
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur
Personnel: H. J. Gribben, manager
Remarks: Uses gases from refineries of Hancock, Richfield, Texaco and General Petroleum.

HANCOCK CHEMICAL CO. 154
Wilmington, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur

HERCULES POWDER CO. 155
Hercules, Calif.
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 50,000 ton/yr
Personnel: E. St. P. Bellinger, manager

HERCULES POWDER CO. 156
Louisiana, Mo.
Approximate investment: $5,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 40,000 ton/yr
Pentaerythritol – 24,000,000 lb/yr
Formaldehyde – 100,000,000 lb/yr
Personnel: J. B. Talley, manager
Remarks: Formaldehyde and pentaerythritol units, at cost of $6,000,000, are scheduled for completion late in 1956.

HERCULES POWDER CO. 157
Burlington, N. J.
Approximate investment: $4,500,000
Hydrocarbon raw materials:
Paraxylene
Products and output:
Dimethyl terephthalate – 12,000,000 lb/yr
Personnel: D. A. Bunce, general manager

HERCULES POWDER CO. 158
Gibbstown, N. J.
Hydrocarbon raw materials:
Benzene and propylene
Cumene
Products and output:
Cumene
Phenol – 26,000,000 lb/yr
Acetone – 16,000,000 lb/yr
Para-cresol
Cymene alcohol
Methyl styrene
Acetophenone
Personnel: L. W. Rothenberger, general manager
Remarks: Company has started pilot scale manufacture of dicumyl peroxide, a cumene derivative.

HERESITE CHEMICAL CO. 159
Manitowoc, Wis.
Hydrocarbon raw materials:
Butadiene and styrene
Products and output:
Polybutadiene-acrylonitrile type acyclic elastomers
Personnel: I. L. Place, manager

HEYDEN CHEMICAL CORP. 160
Location not selected
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Methanol (from natural gas)
Products and output:
Pentaerythritol
Remarks: Planning stage. Completion is scheduled for end of 1956.

HEYDEN CHEMICAL CORP. 161
Texas City, Texas
(See Monsanto Chemical Co., Texas City, Texas)

HIDALGO CHEMICAL CO. 162
Brownsville, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Acetaldehyde
Propionaldehyde
Methanol
Ethanol
Iso-propanol
N-propanol
Iso-butanol
N-butanol
Acetone
Methyl propyl ketone
Methyl ethyl ketone
Methyl butyl ketone
Acetic acid
Propionic acid
Total chemicals – 180,000,000 lb/yr
Personnel: L. L. Smith, superintendent
Remarks: Formerly Carthage Hydrocol Inc., but acquired by Stanolind Oil & Gas Co. in 1954. Hidalgo has signed exclusive contract with R. W. Greef & Co., Inc., for marketing the products. Operations scheduled to begin early 1956. Company also has fast tax write-off on $3,428,000 for process additions.

HOOKER ELECTROCHEMICAL CO. 163
Niagara Falls, N. Y.
Hydrocarbon raw materials:
Benzene
Toluene
Xylene
Pentane
Wax
Products and output:
Chlorbenzenes
Chlortoluenes and their derivatives
Hexachlorocyclopentadiene and chlorinated waxes
Personnel: F. L. Bryant, works manager; D. E. Springer, chief engineer
Remarks: Durez Plastics & Chemicals and Hooker were consolidated, April, 1955.

J. M. HUBER CORP. 164
Baytown, Texas
Remarks: Same as Eldon. (See Huber under Eldon)

J. M. HUBER CORP. 165
Borger, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks
Furnace blacks
Personnel: H. S. Barbour, general manager; J. L. Speir, channel plant superintendent; L. V. Bosom, furnace plant superintendent; J. D. McGregor, chief engineer

J. M. HUBER CORP. 166
Eldon, Texas
Hydrocarbon raw materials:
Oil
Products and output:
Carbon black
Personnel:
M. D. Nuttall, manager; J. B. Stewart, superintendent; Paul Post, chief engineer

HUMBLE OIL & REFINING CO. 167
Baytown, Texas
Approximate investment: $39,491,300
Gross value, products: 1954 – $32,618,100
1955 – $56,960,700
Hydrocarbon raw materials:
Refinery gases
Petroleum fractions
Products and output:
Butadiene – 49,000 ton/yr
Cyclohexane
Butylene concentrate
Toluene
Tetrapropylene
Xylene and paraxylenes
Tripropylene
Aromatic solvents
Butyl rubber – 43,000 ton/yr
Personnel: G. L. Farmer, plant manager; James Harrop, general superintendent; E. F. Voss, chief engineer
Remarks: Butadiene unit was government-owned and operated by Phillips, and purchased in recent disposal for $8,886,000. Same holds for butyl unit, purchased for $17,500,000.

JULIUS HYMAN & CO. 168
Denver, Colo.
(See Shell Chemical Co.)

IMPERIAL SULPHUR AND ACID CO. 169
Framington, N. Mex.
Approximate investment: $350,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 12,600 ton/yr
Personnel: D. E. Cornell, manager

INDEX CHEMICALS CO. 170
Houston, Texas
Hydrocarbon raw materials:
Butane and sulfur
Products and output:
Thiopene
Remarks: Sharples Chemical Division, Pennsylvania Salt Mfg., Co., has licensing agreement with Socony Mobile Oil Co. to manufacture and sell thiophene under Socony patents. Plant at Houston is operated by Index Chemicals Co., a subsidiary of Penn-Salt.

JEFFERSON CHEMICAL CO. 171
Port Neches, Texas
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene glycol
Diethylene glycol
Ethylene oxide
Ethylene dichloride
Mono-, di-, tri-ethanolamine
Nonyl phenol
Aromatic distillate
Morpholine
Personnel: M. H. Holmes, general manager; R. H. Darling, chief engineer
Remarks: Owned jointly by American Cyanamid Co. and The Texas Co.

JEFFERSON LAKE SULPHUR CO. 172
Wanderson, Wyo.
Approximate investment: $700,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 54,750 ton/yr
Personnel: C. H. Lewis, general manager; James Leeper, superintendent

KENDALL REFINING CO.
Bradford, Penna.
Catalytic reformer, not operated for petrochemicals

KENTUCKY SYNTHETIC RUBBER CORP. 174
(See American Synthetic Rubber Corp.)

KOPPERS CO., THE 175
Monaca, Penna. (Kobuta Plant)
Approximate investment: $25,000,000
Gross value, products: 1954 – $25,000,000
1955 – $35,000,000
Hydrocarbon raw materials:
Benzene and ethylene
Butadiene
Products and output:
Styrene monomer – 50,000 ton/yr
Polystyrene – 25,000 ton/yr
Divinyl benzene
Personnel: F. R. Garner, general manager; W. J. Reagan, assistant manager; R. Johnson, chief engineer
Remarks: Butadiene facilities, intermittently operated for government since 1942, purchased by Koppers for $2,000,000 in April, 1955. Butadiene units not currently operating, but being maintained in standby condition.

KOPPERS CO., INC. (Chemical Division) 176
Oil City, Penna.
Approximate investment: $2,000,000
Gross value, products: 1954 – $1,600,000
1955 – $3,000,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alkylated cresols – 2,400,000 lb/yr
Personnel: C. L. Mehring, general manager; G. E. Evans, assistant manager
Remarks: Expansion under way will add 3,600,000 lb/yr of capacity.

KOPPERS CO., INC. (Chemical Division) 177
Port Arthur, Texas (Williams Plant)

(Continued on next page)

(Koppers – Cont.)
Approximate investment: $19,000,000
Gross value, products: 1954 – $7,000,000
1955 – $10,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Ethylbenzene – 120,000,000 lb/yr
Polyethylene
Personnel: H. E. Roche, general manager; E. H. Tenthoff, assistant manager; J. B. Stewart, chief engineer.
Remarks: Polyethylene plant under construction; completion was scheduled for this summer.

LION OIL CO. 178
El Dorado, Ark.
Approximate investment: $40,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 213,000 ton/yr
Ammonium sulfate – 133,000 ton/yr
Ammonium nitrate – 155,500 ton/yr
Nitrogenous fertilizer solutions – 120,000 ton/yr
Nitric acid – 165,000 ton/yr
Sulfuric acid – 112,000 ton/yr
Personnel: A. M. Sprague, superintendent; Jack Ricks, chief engineer
Remarks: Lion is scheduled for merger into Monsanto Chemical Co. pending approval by stockholders, September, 23.

LION OIL CO. 179
Luling, La. (Barton Plant)
Approximate investment: $31,000,000
Hydrocarbon raw materials:
Natural gas
Waste gases
Products and output:
Anhydrous ammonia – 127,750 ton/yr
Ammonium nitrate – 36,500 ton/yr
Dry ice and liquid carbondioxide – 15,330 ton/yr
Nitric acid – 155,000 ton/yr
Personnel: R. L. Van Zandt, superintendent; S. B. Johnson, assistant superintendent

LUBRIZOL CORP. 180
Cleveland, Ohio
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Personnel: C. G. O'Bannon, production manager

LUBRIZOL CORP. 181
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Personnel: K. A. Danskin, manager

LYNN CARBON BLACK CO. 182
Houston, Texas
Approximate investment: $175,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black
Personnel: R. P. Lynn, president; W. H. Baika, chief engineer
Remarks: Investment indicated is for pilot plant to be built by Tellepsen Construction Co. Lynn has severed connections with Consolidated Carbon Corp. of Ill. Plant will use patented Lynn "Furnatic" process. Company plans further expansion by licensing arrangements.

MAGNOLIA PETROLEUM CO. 183
Beaumont, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Cresylic acid
Sodium cresylate solutions
Personnel: J. W. Newton, vice president and general manager; C. M. Fabian, superintendent; G. C. Debney, chief engineer

MARBON CHEMICAL DIVISION (Borg-Warner Corp.) 184
Gary, Ind.
Hydrocarbon raw materials:
Styrene
Butadiene
Products and output:
High styrene resins
Personnel: R. Shattuck, president; J. F. Showalter, superintendent; C. L. Taylor, chief engineer

MARBON CHEMICAL DIVISION (Borg-Warner Corp.) 185
Washington, W. Va.
Products and output:
Styrene resins
Remarks: Marbon has made plans to build this new plant. No further details available.

MATHIESON CHEMICAL CORP. 186
(See Olin Mathieson Chemical Corp.)

THE MERICHEM CO. 187
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Cresylic acid
Phenol-cresol blends
Sodium sulfide
Sodium sulfhydrate
Personnel: J. T. Files, vice president; L. L. Jolly, superintendent; J. D. Ligon, chief engineer

MIDLAND RUBBER CO. 188
Torrance, Calif.
(See Shell Chemical Co.)

MILL CREEK CHEMICAL CO. 189
(See Salt Lake Chemical Co.)

MISSISSIPPI CHEMICAL CORP. 190
Yazoo City, Miss.
Approximate investment – $19,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 95,000 ton/yr
Ammonium nitrate – 140,000 ton/yr
Personnel: W. B. Dunwoody, general operations manager

MISSISSIPPI RIVER FUEL CORP. 191
Crystal City, Mo.
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 72,000 ton/yr
Nitric acid
Ammonium nitrate – 100,800 ton/yr
Personnel: C. H. Lashlee, plant manager
Remarks: Completion scheduled for October, 1955.

MOBAY CHEMICAL CO. 192
New Martinsville, W. Va.
Hydrocarbon raw materials:
Toluene
Adipic acid
Ethylene glycol
Products and output:
Isocyanates
Polyesters
Personnel: D. J. Miller, manager; H. N. Woebcke, chief engineer
Remarks: New company, owned jointly by Monsanto Chemical Co. and Frabenfabriken Bayer A. G. of Germany. New plant to be completed late this year. Some raw material to come from Columbia-Southern Corp. at Natrium, W. Va. Capacity will be "several 100 lbs/month."

MONSANTO CHEMICAL CO. 193
Avon, Calif.
Approximate investment: $5,000,000
Hydrocarbon raw materials:
Refinery gases
Acid sludge
Products and output:
Phenol – 20,000,000 lb/yr
Sulfuric acid – 80,000 ton/yr
Personnel: Dominic Danna, manager
Remarks: Acid operation is jointly with Tide Water Associated Oil Co. Sulfur is also used as part of feed, besides acid sludge and sour gas.

MONSANTO CHEMICAL CO. 194
Texas City, Texas
Approximate investment: $15,300,000
(for vinyl chloride and methanol only)
Hydrocarbon raw materials:
Benzene
Ethylene
Methane
Propane
Natural gas
Products and output:
Hydrogen cyanide
Styrene monomer – 140,000 ton/yr
Vinyl chloride
Acrylonitrile
Polyethylene – 66,000,000 lb/yr
Methanol – 25,000,000 gal/yr
Personnel: J. S. Putnam, plant manager; H. K. Eckert, director of manufacturing
Remarks: Methanol unit operated by Monsanto and Heyden Chemical Corp. Polyethylene capacity is scheduled for 50% increase by 1957. Company has certificate of necessity for $16,800,000 nitrogen products plant.

MORTON-WITHERS CHEMICAL CO. 195
Greensboro, N. C.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sulfonates
Synthetic lubes
Lube oil additives
Total – 20,000,000 lb/yr
Personnel: R. T. Masters, superintendent
Remarks: Capacity indicated has been planned for completion by first of 1955.

NATIONAL DISTILLERS PRODUCTS CO. 196
(See U. S. Industrial Chemical Co.)

NATIONAL PETRO-CHEMICALS CO. 197
Tuscola, Ill.
Approximate investment: $70,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ethanol – 40,000,000 gal/yr
Ethyl chloride – 48,000,000 lb/yr
Ethylene – 200,000,000 lb/yr
Polyethylene – 26,000,000 lb/yr
Ether
Personnel: J. Nixon, manager; S. Siegelman, assistant manager; C. Carnes, chief engineer
Remarks: Owned by National Distillers Products Corp. (60%) and Panhandle Eastern Pipeline Co.

NATURAL GAS ODORIZING CO. 198
Remarks: Same as Thiochemicals, Inc., and company has been dissolved.

HECHES BUTANE PRODUCTS CO. 199
(See Texas-U. S. Chemical Co.)

HEVILLE CHEMICAL CO. 200
Anaheim, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Hydrocarbon resins.
Aromatic solvents
Personnel: R. L. Ulrich, manager

HEVILLE CHEMICAL CO. 201
Neville Island (Pittsburgh), Penna.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Hydrocarbon resins
Aromatic solvents
Personnel: H. J. Shearer, superintendent

NEWPORT INDUSTRIES, INC. 202
Pensacola, Fla.
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen
Remarks: Hydrogen produced by catalytic steam-reforming unit.

NIMOL LABORATORIES 203
Chicago, Ill.
Approximate investment: $750,000
Hydrocarbon raw materials:
Alkylated benzene
Products and output:
Special sulfonates – 15,000,000 lb/yr
Personnel: Jerome Kritchevsky, president

NORTHERN CHEMICAL INDUSTRIES, INC. 204
Searsport, Maine
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Bunker C fuel oil
Products and output:
Anhydrous ammonia – 45,000 ton/yr
Nitric acid – 21,600 ton/yr
Ammonium nitrate – 36,000 ton/yr
Mixed fertilizer – 50,000 ton/yr
Sulfuric acid – 36,500 ton/yr
Personnel: F. L. Litty, manager; Geo. Odom, superintendent; W. J. Ulschner, chief engineer
Remarks: Scheduled for completion February, 1956.

OLD DUTCH REFINING CO. 205
(See Aurora Gasoline Co.)

OLIN MATHIESON CHEMICAL CORP. 206
Magnolia, Ark.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Personnel: J. C. Betteken, operations manager

OLIN MATHIESON CHEMICAL CORP. 207
McKamie, Ark.

(Continued on next page)

(Olin Mathieson Chemical – Cont.)
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Personnel: J. C. Betteken, operations manager

OLIN MATHIESON CHEMICAL CORP. 208
Brandenburg, Ky.
Hydrocarbon raw materials:
Ethane (from natural gas)
Products and output:
Ethylene oxide
Ethylene glycol
Diethylene glycol
Ethylene dichloride
Triethylene glycol
Polyglycols
Glycol ethers
Ethanolamine
Personnel: C. J. Thomas, manager; C. C. Hale, manager of engineering
Remarks: Ethanolamine unit scheduled for completion early in 1956.

OLIN MATHIESON CHEMICAL CORP. 209
Lake Charles, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 95,000 ton/yr
Nitric acid
Sodium nitrate
Hydrazine
Personnel: C.C. Hightower, manager; W.C. Moseley, assistant manager; A.D. Hargroder, chief engineer

OROMITE CHEMICAL CO. 210
Oak Point, La.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Personnel: T. I. Clausen, manager
Remarks: Subsidiary of Standard Oil Co. of Calif. Capacity at Oak Point plant is reported to be sufficient to treat 20,000 b/d of lubricants.

PAN AMERICAN REFINING CORP. 211
(See American Oil Co.)

PAN-AM SOUTHERN CORP. 212
El Dorado, Ark.
Hydrocarbon raw materials:
Propane-propylene
Butane-butylene
Products and output:
Propylene tetramer – 3,800,000 gal/yr
Polybutylene – 2,000,000 gal/yr
Trimer – 350,000 gal/yr
Personnel: E. N. Kimes, manager; J. M. Brown, assistant manager; C. L. Parris, chief engineer

PATHFINDER CHEMICAL CO. 213
Niagara Falls, N. Y.
Hydrocarbon raw materials:
Acetylene
Products and output:
Vinyl resins
Rubber accelerators
Personnel: F. Manchester, manager

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP. 214
Chester, Penna.
Hydrocarbon raw materials:
Crude oil
Products and output:
Butadiene
Naphthalene
Ethylbenzene
Benzene
Ethylene
Isoprene
Dicyclopentadiene
Piperylene
Isopropyl benzene
Personnel: B. F. Schweim, manager; J. D. Vermeychuk, superintendent
Remarks: This a small, 40,000 gal/day plant, used as a pilot unit, but with some commercial production.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP. 215
Clairton, Penna. (West Elizabeth)
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Styrene
Petroleum resins
Personnel: R. A. Taylor, manager
Remarks: West Elizabeth operates on variety of materials, petroleum and coal-tar derivatives, and acts as "feeder" to main plant at Clairton, where all raw materials are coal-tar at present.

PENNSYLVANIA REFINING CO. 216
Karns City, Penna.
Approximate investment: $500,000
Gross value, products: 1954 – $580,000
1955 – $625,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Petroleum sulfonate – 4,000,000 lb/yr
Personnel: John Beck, manager; C. M. McCullough, superintendent

PETROCARBON CHEMICALS, INC. 217
Irving, Texas
Approximate investment: $1,000,000
Hydrocarbon raw materials:
Refinery streams
Products and output:
Benzene
Toluene
Xylenes
Naphthalene
B-T-X total – 1000 b/d

PETROCHEMICALS CO. 218
(See Universal Detergents, Inc.)

PETROLEUM CHEMICALS, INC. 219
Lake Charles, La.
Approximate investment: $17,500,000
Gross value, products: 1955 – $18,000,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Butadiene – 63,000 ton/yr
Personnel: J.H.Olehy, operating manager; J.O.Hartman, superintendent; F. M. Simpson, vice president
Remarks: Company is joint subsidiary of Cities Service Oil Co. and Continental Oil Co., who purchased former government plant (operated by Cities Service). Long range planning includes butyle rubber and ammonia for estimated $29,000,000.

PETRO-TEX CHEMICAL CORP. 220
Houston, Texas
Approximate investment: $24,197,000
Hydrocarbon raw materials:
Butane
Butylene
Products and output:
Butadiene – 90,000 ton/yr
Remarks: New company formed by Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp., bought former government plant (operated by Sinclair). Planning to expand by 50% in next five years.

PHILLIPS CHEMICAL CO. 221
Big Spring, Texas
Hydrocarbon raw materials:
Mixed xylenes
Products and output:
Paraxylene – 3,285,000 lb/yr
Personnel: A. F. Legatski, superintendent
Remarks: Located at Cosden Petroleum Corp. refinery, using Cosden's mixed xylenes.

PHILLIPS CHEMICAL CO. 222
Borger, Texas
Hydrocarbon raw materials:
Liquid fractions
Products and output:
Furnace blacks – 290,000,000 lb/yr
Personnel: H. E. Halton, superintendent

PHILLIPS CHEMICAL CO. 223
Borger, Texas
Approximate investment: $23,525,000
Hydrocarbon raw materials:
Butane
Styrene
Butadiene
Products and output:
Butadiene – 74,000 ton/yr
GR-S rubber – 63,000 ton/yr
Personnel: G. H. Short, superintendent
Remarks: Former government plant, operated by Phillips, purchased in recent disposal program: $19,100,000 for butadiene unit, and $4,525,000 for polymer unit.

PHILLIPS CHEMICAL CO. 224
Crane County, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 31,025 ton/yr
Personnel: A. F. Legatski, superintendent

PHILLIPS CHEMICAL CO. 225
Etter, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 160,000 ton/yr
Ammonium nitrate – 142,000 ton/yr
Nitrogen solutions – 55,000 ton/yr
Nitric acid – 130,000 ton/yr
Personnel: C. W. Forman, superintendent
Remarks: Ammonia plant and part of nitric acid plant government-owned, leased to Phillips.

PHILLIPS CHEMICAL CO. 226
Goldsmith, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 36,500 ton/yr
Personnel: A. F. Legatski, superintendent

PHILLIPS CHEMICAL CO. 227
Pasadena, Texas (Houston)
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 169,725 ton/yr
Ammonium sulfate – 365,000 ton/yr
Methyl vinyl pyridine – 2,000,000 lb/yr
Triple super phosphate – 147,800 ton/yr
Personnel: R. G. Rhodes, superintendent
Remarks: Construction underway of a new unit to produce polyethylene.

PHILLIPS CHEMICAL CO. 228
Sweeney, Texas
Hydrocarbon raw materials:
Butane
Products and output:
Ethylene – 120,000,000 lb/yr
Remarks: Under construction. Completion date is December, 1956.

PHILLIPS PACIFIC CHEMICAL CO. 229
southeastern Washington
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 72,000 ton/yr
Ammonia fertilizers
Remarks: New company, owned jointly by Phillips Petroleum Co. and Pacific Northwest Pipeline Corp. Has arranged for 15,000,000 cfd of natural gas from the pipeline firm. Plant being designed by Phillips Chemical Co., constructed by Fish Engineering Co. Completion date: late 1956.

PRODUCTOL CO. 230
Santa Fe Springs, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Phenols
Cresols
Cresylic acids
Naphthalene
Personnel: E. E. Chipman, manager

PURE OIL CO. 231
Lemont, Ill.
Approximate investment: $300,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur – 5,250 ton/yr
Personnel: J. W. Lawson, manager

THE PURE OIL CO. 232
Toledo, Ohio
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Toluene
Xylene
Aromatic fractions
Personnel: H. H. Dronberger, manager
Remarks: Aromatic products going into motor fuel at present.

PURE OIL CO. 233
Nederland, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Solvents
Personnel: C. W. Cooper, manager; I. L. Hostetler, general superintendent

PUREX CORP. 234
South Gate, Calif.
Hydrocarbon raw materials:
Propylene
Products and output:
Sulfonated alkyl benzene
Personnel: S. M. Dahl, production manager

PUREX CORP. 235
St. Louis, Mo.
Hydrocarbon raw materials:
Propylene
Products and output:
Sulfonated alkyl benzene
Personnel: B. Rich, manager

REICHHOLD CHEMICALS CO. 236
Tuscaloosa, Ala.
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Methanol
Petroleum fractions
Benzene
Products and output:
Pentaerythritol – 5,000,000 lb/yr
Formaldehyde – 30,000,000 lb/yr
Synthetic resins
Phenol
Personnel: W. O. Fetterly, plant manager, B. F. Galloway, superintendent

REICHHOLD CHEMICALS CO. 237
Azusa, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Personnel: J. H. Zeller, manager, J. E. Jared, superintendent

REICHHOLD CHEMICALS CO. 238
San Francisco, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Personnel: M. W. Reece, general manager; S. W. Small, plant manager; C. A. Koski, superintendent
Remarks: Expansion now under way is scheduled for completion early in 1956.

REICHHOLD CHEMICALS CO. 239
Jacksonville, Fla.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Personnel: R. B. Fellows, manager
Remarks: New plant, in operation last month.

REICHHOLD CHEMICALS CO. 240
Ballardvale, Mass.
Hydrocarbon raw materials:
Petroleum fractions
Methanol
Products and output:
Synthetic resins
Formaldehyde
Personnel: R. T. Urich, general manager; H. F. Shepard, plant manager
Remarks: Expansion in resin unit scheduled for completion early in 1956.

REICHHOLD CHEMICALS CO. 241
Detroit, Mich.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Synthetic resins
Personnel: C. J. Windsor, manager; J. W. Milford, superintendent
Remarks: Expansion under way is scheduled for completion early in 1956.

REICHHOLD CHEMICALS CO. 242
Elizabeth, N. J.
Hydrocarbon raw materials:
Petroleum fractions
Benzene
Products and output:
Synthetic resins
Maleic anhydride
Personnel: J. E. d'Angelo, manager; C. G. Matko, chief engineer.
Remarks: Maleic anhydride expansion to be completed before end of this year.

REICHHOLD CHEMICALS CO. 243
Charlotte, N. C.
Hydrocarbon raw materials:
Petroleum fractions
Methanol
Products and output:
Synthetic resins
Formaldehyde
Personnel: G. D. Harmer, superintendent

REICHHOLD CHEMICALS CO. 244
Seattle, Wash.
Hydrocarbon raw materials:
Petroleum complexes
Methanol
Products and output:
Synthetic resins
Formaldehyde
Pentachlorophenol – 360,000 lb/yr
Personnel: H. O. Warner, manager; C. E. Ruiga, chief engineer

REILLY TAR & CHEMICAL CO. 245
Newark, N. J.
Remarks: Plant, which made phenol and cresylic acids from petroleum fractions, was shut down late in August, pending outcome of negotiations for sale of property.

REPUBLIC OIL REFINING CO. 246
Texas City, Texas
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene
Toluene
Xylenes
Personnel: L. W. Robbie, manager
Remarks: Unit operated for motor fuel at present. No plans for change to petrochemicals for some time ahead.

RICHFIELD OIL CORP. 247
Los Angeles, Calif.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene – 25,000,000 lb/yr
Personnel: C. R. McKay, manager

ROHM & HAAS CO. 248
Houston, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Hydrogen cyanide
Carbon monoxide
Chemical intermediates
Personnel: V. C. Henrich, manager
Remarks: Company has a tax write-off approval for a $1,300,000 ammonium sulfate plant.

ROOSEVELT OIL & REFINING CO. 249
Mt. Pleasant, Mich.
Approximate investment: $2,000,000
Gross value, products: 1954 – $1,775,000
1954 – $2,150,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene – 3,000,000 gal/yr
Toluene – 2,400,000 gal/yr
Aliphatic naphthas– 18,000,000 gal/yr
Personnel: E. A. Morrow, manager; Tom Williams, superintendent; Brice Weber, chief engineer

ST. PAUL AMMONIA PRODUCTS, INC. 250
Pine Bend, Minn.
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas & residual oil
Products and output:
Ammonia – 70,000 ton/yr
Nitrogen solutions
Ammonium nitrate
Personnel: Frank W. Wilson, general manager
Remarks: Output of plant will be sold to Central Farmers Fertilizer Co. Plant is scheduled for completion Sept. 1956.

SALT LAKE CHEMICAL CO. 251
Salt Lake City, Utah
Remarks: Project has been abandoned.

SAN JACINTO CHEMICAL CO. 252
Houston, Texas
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 43,200 ton/yr
Personnel: D. A. White, manager
Remarks: Company is a division of Smith-Douglas Co., Norfolk, Va.

SEABOARD OIL CO. 253
Powell, Wyo.
Approximate investment: $1,000,000
Gross value, products: 1954 – $378,000
1955 – $378,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 15,750 ton/yr
Personnel: John A. Tiehen, superintendent; W. R. Strong, foreman

SHAMROCK OIL AND GAS CORP. 254
Sunray, Texas
Approximate investment: $284,690
Gross value, products: 1954 – $342,079
1955 – $401,522
Hydrocarbon raw materials:
Acid gases
Products and output:
Sulfur – 10,800 ton/yr
Personnel: A. V. Beckworth, superintendent; C. D. Van Vliet, chief engineer

SHARPLES CHEMICAL DIVISION, Pennsylvania Salt Mfg. Co. 255
Wyandotte, Mich.
Hydrocarbon raw materials:
Pentane
Tri-isobutylene
Products and output:
Amyl alcohol
Amyl chloride
Amyl acetate
Amyl phenols
Amyl naphthalenes
Amyl mercaptan
Tert-dodecylmercaptan
Tert-dodecylether
Polyethylene glycol
Personnel: H. F. Bjork, manager; R. P. Ogden, production manager, J. W. Mayers, chief engineer

SHELL CHEMICAL CO. 256
Dominguez, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alcohols
Solvents
Other organic chemicals
Personnel: C. M. Williams, manager

SHELL CHEMICAL CO. 257
Gardena, Calif.
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Propane
Benzene
Products and output:
Styrene – 57,000 ton/yr
Toluene
Remarks: Shell purchased this former government plant last spring (previously operated by Dow Chemical Co.).

SHELL CHEMICAL CO. 258
Martinez, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alcohols
Solvents
Other organic chemicals
Para-tertiary-butyl benzoic acid
Lube oil additives
Personnel: E. W. Casagrande

SHELL CHEMICAL CO. 259
Pittsburg, Calif.
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 109,500 ton/yr
Ammonia sulfate
Carbon black
Personnel: E. S. Bodine, manager

SHELL CHEMICAL CO. 260
Torrance, Calif.
Approximate investment: $30,000,000
Hydrocarbon raw materials:
Butylenes
Products and output:
Butadiene – 48,000 ton/yr
Styrene – 62,500 ton/yr
GR-S rubber – 89,000 ton/yr
Personnel: M. Voogd, manager
Remarks: Facilities purchased from government in spring of 1955.

SHELL CHEMICAL CO. 261
Ventura, Calif.
Approximate investment: $10,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 65,000 ton/yr
Urea – 36,000 ton/yr
Personnel: F. D. Kuenzly, manager
Remarks: Urea facilities scheduled for completion in Sept., 1956.

SHELL CHEMICAL CO. 262
Denver, Colo.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Aldrin

(Continued on next page)

(Shell Chemical – Cont.)
Dieldrin
Specialty chemicals
Personnel: J. Bejarano, manager

SHELL CHEMICAL CORP. 263
Norco, La.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Crude chlorohydrins
Allyl chloride, D-D
Hydrogen peroxide
Acrolein
Glycerine – 30,000,000 lb/yr
Personnel: F. E. Caddy, manager
Remarks: Peroxide unit under construction. Acrolein and glycerine units to start later this year. Process differs from that used at Houston plant of Shell.

SHELL CHEMICAL CORP. 264
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alcohols – 20,000,000 gal/yr
Solvents
Epon resins
Glycerine
Bis-phenol A
Personnel: Glenn Purcell, manager

SHELL OIL CO. 265
Martinez, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Petroleum sulfonates
Personnel: Bruno Stolley, manager

SHELL OIL CO. 266
Wilmington, Calif. (Dominguez refinery)
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene – 6,000,000 gal/yr
Toluene
Xylenes
Cyclohexane
Personnel: P. J. Merkus, Jr., manager

SHELL OIL CO. 267
Wood River, Ill.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Toluene
Xylene
Personnel: H. D. Dale, manager

SHELL OIL CO. 268
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene – 19,000,000 gal/yr
Toluene – 33,000,000 gal/yr
Sulfur – 20,000 ton/yr
Personnel: J. A. Tench, manager
Remarks: Sulfur unit is under construction.

SID RICHARDSON CARBON CO. 269
Odessa, Texas
Gross value, products: 1954 – $6,400,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks – 80,000,000 lb/yr
Personnel: H. H. Offutt, manager; L. E. King, superintendent; H. H. Jones, chief engineer

SID RICHARDSON CARBON CO. 270
Odessa, Texas
Approximate investment: $190,000
Gross value, products: 1954 – $140,000
1955 – $160,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 9000 ton/yr
Personnel: G. M. Smith, manager
Remarks: Owned jointly by Sid Richardson and the Odessa Natural Gasoline Co. Operated by Odessa at about 60% of capacity.

SID RICHARDSON GASOLINE CO. 271
Kermit, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Personnel: D. H. Hiff, superintendent

SIGNAL OIL & GAS CO. 272
Tioga, No. Dak.
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Casinghead gas
Products and output:
Sulfur
Personnel: R. L. Cook, superintendent

SIMPSON COAL & CHEMICAL CORP. 273
Natchez, Miss.
Approximate investment: $20,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 60,000 ton/yr
Acetylene – 30,000 ton/yr
Vinyl chloride monomer and polymer
Remarks: Still in planning stage. Project has been shelved temporarily.

SINCLAIR REFINING CO. 274
Wood River, Ill.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Aromatic solvents
Personnel: M. H. Nolan, manager

SINCLAIR REFINING CO. 275
East Chicago, Ind.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Cresylic acids
Gear, turbine & cutting oil additives
Personnel: R. G. Arner, manager

SINCLAIR REFINING CO. 276
Wellsville, N. Y.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Petroleum resins
Personnel: W. B. Chenault, manager

SINCLAIR REFINING CO. 277
Sand Springs, Okla.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Demulsifying agents
Corrosion inhibitors
Sulfonates, acid & oil layer types (sodium salt)

SINCLAIR REFINING CO. 278
Marcus Hook, Pa.
Hydrocarbon raw materials:
Catalytic reformate
Petroleum fractions
Refinery gas
Products and output:
Toluene
Para xylene (98%)
Mixed xylenes
High aromatic solvents
Dodecene
Cresylic acids
Sulfur – 7,000 ton/yr
Personnel: R. J. Self, manager
Remarks: 2300 b/d Udex unit can produce 18,000,000 gal/yr aromatics. Paraxylene unit designed for 10,000,000 lb/yr. Sulfur expansion to 17,000 ton/yr scheduled for completion Jan. 1956.

SINCLAIR REFINING CO. 279
Corpus Christi, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Aromatic solvents
Personnel: E. B. Killick, manager

SINCLAIR REFINING CO. 280
Houston, Texas
Hydrocarbon raw materials:
Petroleum fractions
Refinery gases
Products and output:
Oil-layer type
Sulfonates (barium, calcium & sodium salts)
Corrosion inhibitors
Odorless solvents
Cresylic acids
Sulfur – 10,500 ton/yr
Personnel: J. D. Seifer, manager
Remarks: New facilities planned for continuous manufacture of lube oil additives, replacing existing units for batch type operations.

SINCLAIR RUBBER, INC. 281
Houston, Texas
(See Petro-Tex Chemical Corp.)

SOCONY MOBIL OIL CO. 282
Paulsboro, N. J.
Remarks: Benzonitrile plant stopped operating in December, 1953.

SOCONY MOBIL OIL CO. 283
Buffalo, N. Y.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sodium sulfite
Personnel: C. M. Klaerner, superintendent

J. SONNEBORN SONS, INC. 284
Petrolia, Penna.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Sulfonates
Personnel: H. Schindler, manager

SPENCER CHEMICAL CO. 285
Pittsburg, Kans.
Approximate investment: $11,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 178,000 ton/yr
Methanol
Ammoniating solutions
Ammonium nitrate
Nitric acid
Carbon dioxide
Personnel: V. F. Hobart, manager

SPENCER CHEMICAL CO. 286
Henderson, Ky.
Approximate investment: $3,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 79,000 ton/yr
Nitric acid
Ammoniating solutions
Personnel: R. D. Wallace, works manager
Remarks: Additional units for nitric acid and ammoniating solutions were scheduled for completion late this summer.

SPENCER CHEMICAL CO. 287
Vicksburg, Miss.
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 70,000 ton/yr
Ammoniating solutions
Nitric acid – 36,500 ton/yr
Personnel: W. A. Johnston, manager
Remarks: Expansion in nitric acid and ammoniating solutions at cost of $1,500,000. Completion date spring, 1956.

SPENCER CHEMICAL CO. 288
Orange, Texas
Approximate investment: $12,000,000
Hydrocarbon raw materials:
Ethylene
Products and output:
Polyethylene – 45,000,000 lb/yr
Personnel: Frank Pyle, manager

STANDARD OIL CO. OF CALIF. 289
El Segundo, Calif.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Benzene –
8740 b/d
Toluene –
Paraxylene
Cumene
Butadiene – butylene mixtures – 50,000 ton/yr
Aliphatic acids
Gas odorants
Personnel: D. K. Harger, manager
Remarks: Crude butadiene-butylene mixture stream is shipped to Shell Chemical Co. butadiene plant at Torrance. Investment in butadiene unit is $15,000,000

STANDARD OIL CO. OF CALIFORNIA 290
Richmond, Calif.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Para xylenes – 35,000,000 lb/yr
Ortho xylene
Industrial xylenes
Alkyl aromatic detergents
Metallic naphthenates & naphthenic acids
Cresylic acids

(Continued on next page)

(Standard Oil of California – Cont.)
Petroleum sulfonates
Polybutenes
Gas odorants
Ethyl mercaptans
Phthalic anhydride
Phenol – 35,000,000 lb/yr
Acetone – 20,000,000 lb/yr
Isophthalic acid – 50,000,000 lb/yr
Personnel: R. K. Rowell, gen'l manager
Remarks: Company planning $16,000,000 program in fertilizer manufacturing, ammonia– (and nitric acid)– from by-product hydrogen plant to be constructed. Subsidiary company, California Spray Chemical Corp., will build a plant to convert Standard's output into fertilizers. Planned capacity of combined facilities is 300 ton/day of ammonia. Completion expected mid-1956. Investment value of phenol unit is $4,000,000; isophthalic acid unit, $10,900,000.

STANDARD OIL CO. (INDIANA) 291
Wood River, Ill.
Hydrocarbon raw materials:
Heptene heartcut from olefin feed
Petroleum fractions
Products and output:
Iso-octyl, decyl, or higher alcohols – 10,000,000 lb/yr
Polybutylene and higher molecular wts
Lube oil additives
Plasticizers
Personnel: H. E. Cotton, manager; F. H. Blunck, superintendent; J. K. Roedel, chief engineer

STANDARD OIL CO. (INDIANA) 292
Whiting, Ind.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene – 260,000 bbl/yr
Toluene – 450,000 bbl/yr
Xylenes – 220,000 bbl/yr
Sulfur – 19,250 ton/yr
Detergent alkylate – 55,000,000 lb/yr
Personnel: A. F. Endres, manager; A. H. Hayes, general superintendent; P. L. Krauel, chief engineer
Remarks: B-T-X to be produced in Udex unit to be completed in November. Other facilities are operating.

STANDARD OIL CO. (INDIANA) 293
Sugar Creek, Mo.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
C7 olefin concentrate – 117,000 bbl/yr
Personnel: H. R. Boehmer, manager; P. C. Livesay, general superintendent; G. W. Larson, chief engineer
Remarks: Supplies raw material to Wood River Oxo alcohol units.

STANDARD OIL CO. (OHIO) 294
Lima, Ohio
Approximate investment: $17,000,000
Hydrocarbon raw materials:
Natural gas
Hydrogen (from reforming)
Products and output:
Anhydrous ammonia – 109,500 ton/yr
Urea – 43,750 ton/yr
Nitric acid – 21,000 ton/yr
Nitrogen solutions – 70,000 ton/yr
Dry ice – 54,750,000 lb/yr
Personnel: E. F. Morrill, general manager
Remarks: Scheduled for completion in November, except dry ice unit, which is set for May 1956.

STANOLIND OIL & GAS CO. 295
Brownsville, Texas
(See Hidalgo Chemical Co.)

STANOLIND OIL & GAS CO. 296
North Cowden, Texas
Approximate investment: $11,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 6,200 ton/yr
Personnel: Errol R. Wagner, superintendent

STANOLIND OIL & GAS CO. 297
Sundown, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 17,150 ton/yr
Personnel: H. K. Boswell, superintendent

STANOLIND OIL & GAS CO. 298
Powell, Wyo. (Elk Basin Field)
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 23,700 ton/yr
Personnel: A. H. Denny, superintendent

STAUFFER CHEMICAL CO. 299
Mobile, Ala.
Hydrocarbon raw materials:
Natural gas & sulfur
Products and output:
Carbon disulfide
Personnel: Gordon Mitchell, manager
Remarks: Scheduled for completion, spring, 1956. Described as a "multi-million dollar investment."

STAUFFER CHEMICAL CO. 300
Dominguez Jct., Calif.
Hydrocarbon raw materials:
Refinery gases
Acid sludge
Products and output:
Sulfuric acid
Personnel: W. E. H. Knight, manager

STAUFFER CHEMICAL CO. 301
Richmond, Calif. (Stege)
Hydrocarbon raw materials:
Refinery acid sludge
Products and output:
Sulfuric acid
Personnel: J. S. Edwards, manager

STAUFFER CHEMICAL CO. 302
Hammond, Ind.
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Refinery acid sludge
Products and output:
Sulfuric acid
Personnel: C. A. Barton, manager

STAUFFER CHEMICAL CO. 303
Louisville, Ky.
Approximate investment: $3,600,000
Hydrocarbon raw materials:
Propane – propylene
Products and output:
Carbon tetrachloride
Perchlorethylene
Hydrogen chloride
Personnel: H. L. McLean, superintendent

SUN OIL CO. 304
Toledo, Ohio
Hydrocarbon raw materials:
Refinery streams
Reformer tail gas
Products and output:
Butylenes
Propylene tetramer
Hydrogen
Personnel: G. W. Closs, manager; J. F. Harron, superintendent

SUN OIL CO. 305
Marcus Hook, Penna.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Benzene – 19,000,000 gal./yr
Toluene – 30,000,000 gal./yr
Xylene – 18,000,000 gal./yr
Sulfonates
Naphthenic acids
Propylene trimer and tetramer
Anhydrous ammonia – 109,500 ton/yr
Personnel: W. T. Askew, manager
Remarks: Ammonia unit completion scheduled for late this year; cost, $9,000,000. Investment in the B-T-X unit is $15,000,000.

SUNRAY OIL CORP. 306
Duncan, Okla.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Propylene tetramer
Personnel: R. L. Johnson, manager
Remarks: Wholly-owned subsidiary of Sunray Mid-Continent Oil Co.

SUNTIDE REFINING CO. 307
Corpus Christi, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Propylene tetramer
Personnel: A. T. Smith, manager

TAYLOR OIL AND GAS CO. 308
(See Delhi Taylor Oil Corp.)

TENNESSEE EASTMAN CO. 309
Kingsport, Tenn.
Hydrocarbon raw materials:
Natural gas or LPG
Products and output:
Hydrogen
Remarks: Completion scheduled January, 1956.

THE TEXAS CO. 310
Port Arthur, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Naphthenic acids
Sulfonates
Butylenes
Propylene tetramer
Personnel: F. L. Wallace, manager

TEXAS BUTADIENE & CHEMICAL CORP. 311
Houston, Texas
Approximate investment: $26,000,000
Hydrocarbon raw materials:
Butanes
Products and output:
Butadiene – 43,000 ton/yr
Alkylate
Butylenes
Remarks: Company re-organized last July. Participants include: Carl M. Loeb, Rhoades & Co., and Godfrey L. Cabot, Inc. Plant will be able to make up to 2,500,000 bbl/yr of alkylate by cutting butadiene to 17,000 ton/yr. Design and engrg. contractor is Fluor Corp. Completion date: Dec. 1956.

TEXAS EASTMAN CO. 312
Longview, Texas
Hydrocarbon raw materials:
Natural gas (ethane, propane)
Products and output:
N- and iso-butyraldehyde
Ethanol
Ethyl hexyl alcohol
Iso-butyl alcohol
Polyethylene
Personnel: D. C. Hull, vice president and manager
Remarks: Expansion in Oxo facilities (alcohol) is underway, with completion expected this fall. Provision is also being made for expansion to make neo-pentyl glycol and trimethyl pentanediol from iso-butyraldehyde.

TEXAS GAS CORP. 313
Winne, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Methanol
Acetaldehyde
Formaldehyde
Personnel: Paul Bearden, manager
Remarks: No petrochemical products being made at present. Part of plant is in use to supplement facilities in adjacent motor gasoline and LPG plant. Rest of plant is in stand-by and could be returned to petrochemical operation at any time.

TEXAS GULF SULPHUR CO. 314
Worland, Wyo.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 108,000 ton/yr
Personnel: J. W. Estep, manager

TEXAS-U.S. CHEMICAL CO. 315
Port Neches, Texas
Approximate investment: $38,000,000
Hydrocarbon raw materials:
Butylene
Butadiene
Products and output:
Butadiene – 95,000 ton/yr
GR-S rubber – 88,000 ton/yr
Personnel: T. A. McCoy, manager; J. J. Koch, superintendent
Remarks: Texas-U.S. shares ownership in a 190,000 ton/yr butadiene plant with Goodrich-Gulf.

THERMATOMIC CARBON CO. 316
Sterlington, La.
Gross value, products: 1954 – $3,560,000
1955 – $4,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon black – 90,000,000 lb/yr
Personnel: R. W. Gretney, vice president and general manager; S. S. Gill, superintendent
Remarks: A 15% expansion currently under way is scheduled for completion in January, 1956.

THUNDERBIRD CHEMICAL, INC. 317
near Kyrene, Ariz.
Approximate investment: $13,000,000

(Continued on next page)

(Thunderbird Chemical – Cont.)
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia
Urea
Ammonium phosphates
Ammonium sulfate
Remarks: Plans are being drawn up by Ebasco Services, Inc., N. Y. C. Construction is expected to start early, 1956, probably much sooner. Information in Phoenix indicates Ebasco can give further information on plans.

TIDE WATER ASSOCIATED OIL CO. 318
Delaware City, Del.
Hydrocarbon raw materials:
Sour refinery streams
Products and output:
Sulfur
Remarks: New refinery, under construction.

UNION OIL CO. OF CALIFORNIA 319
Oleum, Calif.
Approximate investment: $600,000
Hydrocarbon raw materials:
Refinery gases and wastes
Products and output:
Sulfur – 18,250 ton/yr
Personnel: J. W. Towler, manager

UNION OIL CO. OF CALIFORNIA 320
Santa Maria, Calif.
Approximate investment: $825,000
Hydrocarbon raw materials:
Refinery and natural gases
Products and output:
Sulfur – 15,000 ton/yr
Dry ice and carbon dioxide – 18,250 ton/yr
Personnel: W. Jamieson, superintendent

UNION OIL CO. OF CALIFORNIA 321
Wilmington, Calif.
Approximate investment: $1,800,000
Hydrocarbon raw materials:
Refinery gases and wastes
Products and output:
Sulfur – 14,000 ton/yr
Ammonium sulfate – 20,000 ton/yr
Methyl and ethyl mercaptans – 500,000 lb/yr
Personnel: H. C. Meiners, manager

UNITED CARBON CO., INC. 322
Ryus, Kans.
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace blacks
Personnel: Paul Grimsley, superintendent

UNITED CARBON CO., INC. 323
Franklin, La.
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace blacks
Personnel: W. J. Graham, superintendent

UNITED CARBON CO., INC. 324
Rayville, La.
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks
Personnel: J. H. Mann, superintendent

UNITED CARBON CO., INC. 325
Swartz, La.
Remarks: Plant has been dismantled.

UNITED CARBON CO., INC. 326
Eunice, N. Mex.
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks
Personnel: L. L. Eubanks, superintendent

UNITED CARBON CO., INC. 327
Aransas Pass, Texas
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace and channel blacks
Personnel: Frank Gathright, superintendent

UNITED CARBON CO., INC. 328
Baytown, Texas
Approximate investment: $7,153,000
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
GR-S rubber – 44,000 ton/yr
Personnel: Ted Lyman, manager
Remarks: Former government-owned plant, operated by General Tire & Rubber Co., purchased by United Carbon Co. in July, 1955.

UNITED CARBON CO., INC. 329
Borger, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks

UNITED CARBON CO., INC. 330
Falfurrias, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks

UNITED CARBON CO., INC. 331
Shamrock, Texas
Hydrocarbon raw materials:
Natural gas and oil
Products and output:
Furnace blacks
Personnel: H. L. Teegerstrom, superintendent

UNITED CARBON, INC. 332
Stinnett, Texas
Hydrocarbon raw materials:
Natural gas
Products and output:
Channel blacks

UNITED CHEMICAL CO. 333
Timpson, Texas
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 57,600 ton/yr
Urea – 115,200 ton/yr
Remarks: New plant, still in planning stages.

U. S. INDUSTRIAL CHEMICALS CO.
(A Division of National Distillers Products Corp.) 334
Tuscola, Ill.
Approximate investment: $12,000,000
Hydrocarbon raw materials:
Natural gas streams
Products and output:
Anhydrous ammonia – 45,000 ton/yr
Nitrogenous fertilizers
Sulfuric acid – 140,000 ton/yr
Personnel: D. J. Patterson, manager; Wm. Powell, assistant manager; Wm. Mendel, chief engineer
Remarks: Sulfuric acid plant, a $2,000,000 investment, is now under construction. Company plans a 25,000 ton/yr expansion in ammonia by mid-1956.

U. S. RUBBER CO.
(Naugatuck Chemical Division) 335
Naugatuck, Conn.
Hydrocarbon raw materials:
Butadiene
Styrene
Products and output:
Synthetic rubber
Didecyl mercaptan
Personnel: P. E. Rice, manager

U. S. RUBBER CO.
(Naugatuck Chemical Division) 336
Joliet, Ill.
Hydrocarbon raw materials:
Toluene
Products and output:
Explosives
Remarks: Information restricted by government security regulations.

U. S. RUBBER CO.
(Naugatuck Chemical Division) 337
Baton Rouge, La.
Products and output:
Nitrile type rubbers
Plastics
Molding powders
Remarks: A $1,400,000 investment in styrene-acrylonitrile and rubber blends facilities is under construction.

U. S. RUBBER CO. 338
Port Neches, Texas
(See Texas-U. S. Chemical Co.)

UNIVERSAL DETERGENTS, INC. 339
Long Beach, Calif.
Approximate investment: $1,200,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Alkyl aryl sulfonates – 4320 ton/yr
Aromatic solvents – 60,000 bbl/yr
Personnel: B. R. Bryant, general manager

UTAH CHEMICAL CO. 340
Mt. Pleasant, Utah
Approximate investment: $9,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Anhydrous ammonia – 54,000 ton/yr
Personnel: N. G. Morgan, Jr., president
Remarks: New plant, still in planning stages.

VELSICOL CORP. 341
Marshall, Ill.
Hydrocarbon raw materials:
Petroleum base stocks
Products and output:
Benzene
Toluene
Xylenes
Petroleum polymers
Petroleum resins
Insecticides
Mixed aromatic solvents
Personnel: W. K. McCready, manager; W. Camp, superintendent; H. Sandeker, chief engineer

VISCO PRODUCTS CO. 342
Anaheim, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Oil treating chemicals
Personnel: E. T. Kocher, manager

VISCO PRODUCTS CO. 343
Sugar Land, Texas
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Oil treating chemicals
Personnel: W. H. Kirkpatrick, vice president

WARREN PETROLEUM CORP. 344
Monument, N. Mex.
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Personnel: L. A. Walker, superintendent
Remarks: Plant is owned by Allied Chemical & Dye Corp., and operated by Warren.

WARREN PETROLEUM CORP. 345
Conroe, Texas
Approximate investment: $2,000,000
Hydrocarbon raw materials:
Butane and propane
Products and output:
Pentaerythritol – 2,500,000 lb/yr
Methanol – 4,000,000 lb/yr
Acetaldehyde – 2,000,000 lb/yr
Personnel: Sam Summers, superintendent
Remarks: LPG comes from Warren affiliate, Midland Gasoline Co. at Conroe.

WARWICK WAX CO., INC. 346
Chanute, Kans.
Hydrocarbon raw materials:
Sludge from oil storage tank bottoms
Products and output:
Petroleum waxes
Personnel: G. Hatfield, manager

WESTVACO CHLOR-ALKALI DIVISION
(Food Machinery & Chemical Corp.) 347
So. Charleston, W. Va.
Hydrocarbon raw materials:
Natural gas
Products and output:
Carbon bisulfide
Personnel: R. J. De Largey, manager; N. Elphick, superintendent; L. Hundley, chief engineer

WILSHIRE OIL CO. 348
Norwalk, Calif.
Approximate investment: $175,000
Gross value, products: 1954 – $175,000
1955 – $175,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Sulfur – 5,400 ton/yr
Personnel: J. H. Onding, manager

WITCO CARBON CO. 349
Eunice, N. Mex.
Remarks: See under Continental Carbon Co., who purchased this plant.

WYANDOTTE CHEMICALS CORP. 350
Wyandotte, Mich.
Approximate investment: $7,000,000
Hydrocarbon raw materials:

(Continued on next page)

(Wyandotte Chemicals – Cont.)
Crude oil and fractions
Products and output:
Ethylene glycol
Diethylene glycol
Ethylene dichloride
Chlorinated solvents
Alkyl aryl sulfonate
Synthetic detergents
Sodium carboxy-methyl cellulose
Personnel: F. B. Walcott, vice president

WYNN OIL CO. 351
Azusa, Calif.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Personnel: A. Foss, production manager

Petrochemical Plants in Canada

B. A.-SHAWINIGAN, LTD. 352
Montreal, Que.
Approximate investment: $4,000,000
Gross value, products: 1954 – $1,500,000
1955 – $2,500,000
Hydrocarbon raw materials:
Cumene
Products and output:
Phenol – 13,000,000 lb/yr
Acetone – 8,000,000 lb/yr
Alpha methyl styrene – 20,000,000 lb/yr
Isopropanol – 3,000,000 lb/yr
Personnel: R. H. Hull, manager; R. B. Walker, chief engineer

BAKELITE CORP. 353
Belleville, Ont.
Hydrocarbon raw materials:
Methanol
Products and output:
Formaldehyde

BRITISH AMERICAN OIL CO. 354
Montreal, Que.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Cumene – 4,000,000 lb/yr
Personnel: J. A. McHardy, manager
Remarks: Cumene is raw material for B.A.-Shawinigan.

BRITISH DOMINION OIL CO. 355
(See Northwest Nitro-Chemicals Ltd.)

CABOT CARBON CO. OF CANADA LTD. 356
Sarnia, Ont.
Approximate investment: $3,500,000
Gross value, products: 1954 – $2,500,000
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Furnace blacks – 40,000,000 lb/yr
Personnel: G. H. Cash, executive vice president; W. F. Hendricks, manager; J. A. Satterfield, superintendent; A. J. McKenzie, chief engineer
Remarks: Capacity shown includes 20,000,000 lb/yr now under construction.

CANADIAN CHEMICAL CO., LTD. 357
Edmonton, Alberta
Hydrocarbon raw materials:
Natural gas (propane and butane)
Products and output:
Pentaerythritol
Alcohols
Aldehydes
Esters
Glycols
Glycol-ethers
Ketones
Acetic acid and anhydride
Oxides
Cellulose acetate
Solvents
Personnel: V. T. Amuyll, manager; H. K. Busch, production manager; J. C. Langford, chief engineer
Remarks: Company is Canadian affiliate of Celanese Corp. of America.

CANADIAN GULF OIL CORP. 358
Pincher Creek, Alberta
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur
Remarks: Project held in abeyance, pending governmental approval of plan providing for outlet of Pincher Creek gas.

CANADIAN HYDROCARBONS, LTD. 359
Winnipeg, Manitoba
Approximate investment: $1,500,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 29,200 ton/yr
Nitrogenous fertilizers – 219,000 ton/yr
Remarks: New company incorporated early this year by Winnipeg & Central Gas Co. Plant in planning stages.

CANADIAN INDUSTRIES (1954), LTD. 360
Edmonton, Alberta
Approximate investment: $15,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Polyethylene – 16,000,000 lb/yr
Personnel: S. T. Jones, manager; G. L. McElroy, chief engineer

CANADIAN INDUSTRIES (1954), LTD. 361
Millhaven, Ont.
Approximate investment: $20,000,000
Hydrocarbon raw materials:
Refinery or natural gases
Ethylene glycol
Dimethyl terephthalate
Products and output:
Ammonia – 73,000 ton/yr
Terylene – 11,000,000 lb/yr
Remarks: Ammonia plant construction to start late this year. Terylene started in June.

CARBIDE CHEMICALS CO. (Division of Union Carbide Canada Ltd.) 362
Montreal East, Que.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene glycol
Polyethylene
Personnel: H. D. Lyon, superintendent; R. S. Hughes, staff engineer
Remarks: Formerly plant of Standard Chemical Co., Ltd. a division of Dominion Tar & Chemical Co., Ltd., sold to Carbide in October, 1954, and presently in a state of conversion to products indicated.

CONSOLIDATED MINING & SMELTING CO. OF CANADA, LTD. 363
Calgary, Alberta
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 130,000 ton/yr
Ammonium nitrate
Personnel: R. S. Woodford, superintendent

DOW CHEMICAL OF CANADA, LTD. 364
Sarnia, Ont.
Approximate investment: $35,000,000
Gross value, products: 1954 – $25,000,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Ethylene
Ethylene oxide
Ethylene glycol
Styrene
Carbon tetrachloride
Ammonia – 36,500 ton/yr
Trichloroethylene
Perchloroethylene latices
Polystyrene
Other organic chemicals
Personnel: P. D. Scott, manager
Remarks: A $1,000,000 ethanolamine plant is under construction.

Du PONT CO. OF CANADA, LTD. 365
Maitland, Ont.
Hydrocarbon raw materials:
Cyclohexane
Products and output:
Hexamethylene diamine
Adipic acid
Personnel: A. T. Fell, manager

ETHYL CORP. OF CANADA, LTD. 366
Sarnia, Ont.
Approximate investment: $14,000,000
Hydrocarbon raw materials:
Ethane and ethylene
Products and output:
Anti-knock fluids
Personnel: A. C. Tully, president; O. B. Lewis, vice president; R. T. Edgar, manager; E. F. Diedrich, assistant manager; C. L. Weeks, chief engineer
Remarks: New plant, scheduled for completion August, 1956.

IMPERIAL CHEMICAL INDUSTRIES OF CANADA, LTD. 367
Millhaven, Ont.
(See Canadian Industries (1954) Ltd.)

INLAND CHEMICALS OF CANADA, LTD. 368
Fort Saskatchewan, Alberta
Approximate investment: $1,000,000
Hydrocarbon raw materials:
Sulfur
Products and output:
Sulfuric acid – 36,500 ton/yr
Personnel: G. S. Grant, manager
Remarks: In planning stage. Lummus Co. has contract. Sulfur will come from Shell at Jumping Pound.

LUBRIZOL OF CANADA, LTD. 369
Niagara Falls, Ont.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Lube oil additives
Personnel: M. A. Payne, manager

MONSANTO CANADA, LTD. 370
Montreal, Que.
Hydrocarbon raw materials:
Petroleum base stock
Products and output:
Polystyrene
Personnel: H. Dixon, manager

S. NORD CHEMICAL CO. 371
Petrolia, Ont.
Approximate investment: $1,500,000
Hydrocarbon raw materials:
Catalytic reformate
Products and output:
Benzene)
Toluene) – 30,000,000 gal./yr
Xylenes)
Naphthas
Personnel: Sol Nord, manager
Remarks: Expansion program scheduled for completion at end 1956.

NORTHWEST NITRO-CHEMICALS, LTD. 372
Medicine Hat, Alberta
Approximate investment: $18,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Nitrogeneous fertilizers
Remarks: A new company, organized by Commercial Solvents Corp. (who will manage and operate the venture), New British Dominion Oil Co. Ltd.; Ford, Bacon & Davis, Inc.; and Mr. Frank McMahon. The plant is scheduled for completion late 1956.

POLYMER CORP., LTD. 373
Sarnia, Ont.
Approximate investment: $70,000,000
Gross value, products: 1954 – $53,000,000
Hydrocarbon raw materials:
Refinery gases
Products and output:
Styrene monomer
Ethylene
Isobutylene
Butyl and butadiene rubbers – 85,000 ton/yr
Personnel: L. D. Dougan, manager

QUEBEC AMMONIA CO., LTD. 374
Contrecoeur, Que. (near Montreal)
Approximate investment: $8,500,000
Hydrocarbon raw materials:
Fuel oil
Products and output:
Ammonia – 43,800 ton/yr
Remarks: Lummus Co. Ltd. is building. Completion date not revealed.

ROYALITE OIL CO., LTD. 375
Turner Valley, Alberta
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 14,400 ton/yr
Personnel: C. J. Pearson, superintendent

ST. MAURICE CHEMICAL CO. 376
Varennes, Que.
Hydrocarbon raw materials:
Methanol
Acetaldehyde
Products and output:
Formaldehyde
Pentaerythritol
Personnel: Hal Norton, manager
Remarks: Company owned jointly by Shawinigan Chemicals Co. and Heyden Chemical Corp.

SHELL OIL CO. OF CANADA LTD. 377
Jumping Pound, Alberta
Approximate investment: $1,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Sulfur – 28,800 ton/yr
Personnel: T. B. Smith, manager

SHELL OIL CO. OF CANADA, LTD. 378
Montreal, Que.
Approximate investment: $4,000,000
Hydrocarbon raw materials:
Refinery gases
Propylene
Products and output:
Isopropyl alcohol
Acetone
Total – 36,000,000 lb/yr
Personnel: M. C. Davidson, manager; J. E. Nichol, superintendent

SHERRIT GORDON MINES, INC. 379
Fort Saskatchewan, Alberta
Approximate investment: $24,000,000
Hydrocarbon raw materials:
Natural gas
Products and output:
Ammonia – 27,000 ton/yr
Ammonium sulfate – 72,000 ton/yr
Personnel: Sydney Nashner, manager; C. A. Hanes, V. N. McKim, W. H. Young, assistant managers; J. Ferguson, general superintendent; M. C. Robinson, general superintendent, engineering.
Remarks: Ammonia is used in treating nickel concentrates at company mine at Lynn Lake, Man. The ammonium sulfate is a by-product of the process.

STANDARD CHEMICAL CO., LTD. 380
(See Carbide Chemicals Co., Ltd.)

SUN OIL CO., LTD. 381
Sarnia, Ont.
Hydrocarbon raw materials:
Refinery gases
Products and output:
Butylenes
Personnel: G. R. Henderson, manager

SURPASS PETROCHEMICALS, LTD. 382
Scarborough, Ont.
Hydrocarbon raw materials:
Petroleum fractions
Products and output:
Rust preventives
Engine oil additives
Remarks: Plant still in planning stages.

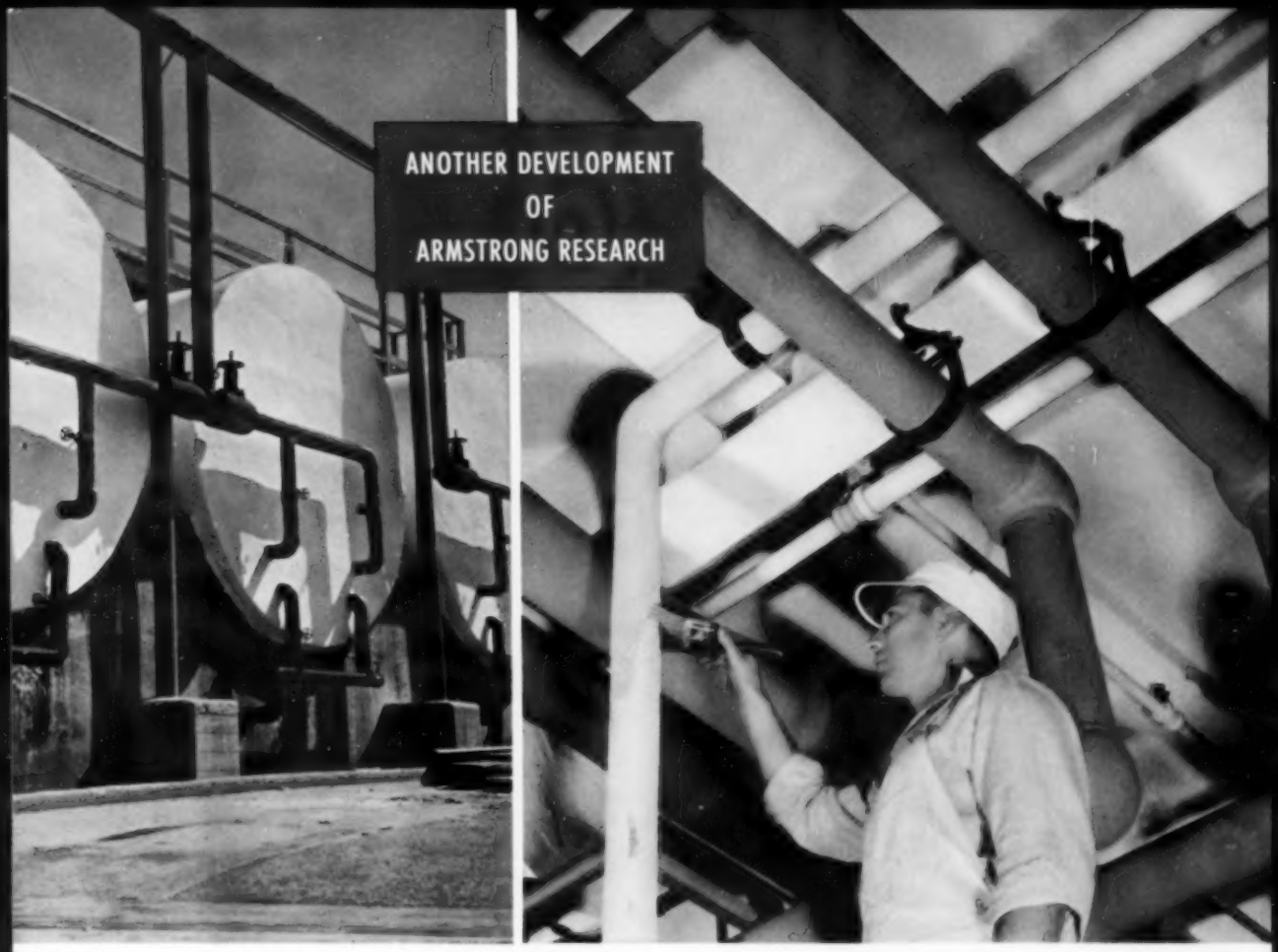
Which Plants Make What Petrochemicals?

The following index is a guide to products made by the companies in the preceding list. Numbers correspond to numbers following each plant.

The information is based only on that reported by the individual companies. Since some manufacturers prefer not to report all specific products, no claim can be made as to the completeness of the list with respect to all companies.

Acetaldehyde – 53, 54, 59, 60, 162, 313, 345
Acetals – 49
Acetic acid – 45, 47, 48, 53, 54, 162, 357
Acetic anhydride – 45, 47, 48, 54
Acetone – 47, 53, 59, 60, 123, 158, 162, 290, 352, 378
Acetophenone – 158
Acetylene – 14, 47, 121, 273
Acrolein – 263
Acrylonitrile – 14, 56, 194
Additives (cutting oil) – 13, 275
Additives (lubricating oil) – 13, 123, 149, 180, 181, 195, 210, 233, 256, 275, 291, 351, 369, 382
Adipic acid – 116, 365
Adiponitrile – 117
Alcohols – 47, 49, 256, 258, 264, 357
Aldehydes – 49, 357
Aldrin – 262
Aliphatic acids – 289
Aliphatic naphthas – 249
Alkyl aromatic detergents – 290
Alkyl aryl sulfonates – 339, 350
Alkylate – 292, 311
Alkylated cresols – 176
Alkyl chloride, D–D – 263
Alpha methyl styrene – 110, 352
Ammonia – 6, 7, 9, 14, 17, 18, 20, 28, 43, 57, 61, 81, 95, 98, 111, 121, 146, 155, 156, 178, 179, 190, 191, 204, 209, 225, 227, 229, 250, 252, 259, 261, 273, 285, 286, 287, 294, 305, 317, 333, 334, 340, 359, 361, 363, 364, 374, 379
Ammoniating solutions – 285, 286, 287
Ammonium nitrate – 28, 81, 95, 121, 178, 179, 190, 191, 204, 225, 250, 285, 363
Ammonium phosphate – 27, 28, 29, 227, 317
Ammonium sulfate – 61, 132, 178, 227, 259, 317, 321, 379
Amyl acetate – 255
Amyl alcohol – 255
Amyl chloride – 255
Amyl mercaptan – 255
Amyl naphthalenes – 255
Amyl phenols – 255
Anhydrides – 49, 357
Anti-knock compounds – 112, 124, 125, 366
Aromatic and aliphatic solvents – 118, 167, 200, 201, 274, 278, 279, 339, 341
Aromatic distillate – 171
Aromatic fractions – 232
Aromatic mixtures – 93, 99
Aromatic tars – 122
Benzene – 21, 91, 93, 97, 118, 148, 214, 217, 246, 249, 266, 268, 289, 292, 305, 341, 371
Benzene hexachloride – 104, 115, 124
Benzene petroleum resins – 122
Bis-phenol A – 264
Butadiene – 11, 46, 96, 110, 111, 122, 167, 214, 219, 220, 223, 260, 311, 315
Butadiene-butylene mixtures – 289
Butanol – 48, 53, 162
Butanol (secondary) – 123
Butyl acetate – 53
Butyl acetate (secondary) – 123
Butyl, 2,4-dichlorophenoxyacetate – 42
Butylene – 148, 167, 304, 310, 311, 381
Butylene glycol – 53
Butyraldehyde – 312
Butyric acid – 54
Carbon bisulfide – 25, 285, 299, 347
Carbon blacks – 26, 31, 32, 33, 34, 35, 36, 38, 39, 41, 50, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 86, 87, 88, 89, 165, 166, 182, 222, 259, 269, 316, 322, 323, 324, 326, 327, 329, 330, 331, 332, 356
Carbon monoxide – 248
Carbon tetrachloride – 12, 102, 107, 111, 303, 364
Carbonate fungicides – 115
Cellulose acetate – 357
Chlorinated benzene – 63
Chlorinated paraffin – 102
Chlorinated solvents – 350
Chlorinated waxes – 163
Chlorobenzene – 163
Chloroform – 12, 105, 107, 111
Chlorohydrins – 263
Chlorotoluene – 163
Corrosion inhibitors – 277, 280
Cresol – 230
Cresylic acid – 183, 187, 230, 245, 275, 278, 280, 290

Cumene – 158, 289, 354
Cyclohexane – 167, 266
Cymene alcohol – 158
Decyl alcohol – 122
Demulsifying agents – 277
Dichloroethylene – 110, 111
Dichloro isopropyl ether – 111
2,4-dichlorophenoxy acetic acid, dimethylamine salt – 42
Dicyclopentadiene – 214
Dieldrin – 262
Diethylbenzene – 110
Diethylene glycol – 111, 171, 208, 350
Dimethyl formamide – 115
Dimethyl terephthalate – 157
Dipropylene glycol – 53
Divinyl benzene – 110, 175
Dodecene – 91, 278
Dodecyl mercaptan – 335
Dry ice and liquid carbon dioxide – 28, 179, 320
Epon (R) resins – 264
Espesol – 118
Esters – 357
Ethanol – 48, 122, 162, 197, 312
Ethanolamines – 8, 110, 171, 208
Ethers – 49, 197
Ethylbenzene – 110, 177, 214
Ethyl cellulose – 110
Ethyl chloride – 110, 111, 124, 125, 197
Ethylene – 152, 197, 214, 228, 247, 364, 373
Ethylene amines – 47, 110
Ethylene dibromide – 110, 124, 126
Ethylene dichloride – 103, 110, 111, 125, 171, 208, 350
Ethylene glycol – 8, 44, 45, 46, 110, 111, 171, 208, 350, 362, 364
Ethylene glycol diacetate – 53
Ethylene glycol mono-oleate – 42
Ethylene oxide – 8, 44, 46, 110, 111, 171, 208, 364
Ethyl ether – 122
2-ethylhexanol – 48
Ethylhexanol – 312
Ethyl mercaptans – 290, 321
Explosives – 336
Fluorinated hydrocarbons – 112
Formaldehyde – 7, 53, 59, 60, 156, 236, 240, 243, 244, 313, 353, 376
Gas odorants – 289, 290
Glycerine – 263, 264
Glycols – 47, 48, 49, 357
Glycol ethers – 208, 357
Hexachlorobenzene – 101
Hexachlorocyclopentadiene – 163
Hexamethylene diamine – 116, 365
Hydrazine – 209
Hydrocarbon resins – 200, 201
Hydrocyanic acid – 14
Hydrogen – 139, 282, 304
Hydrogen chloride – 102, 103, 303
Hydrogen cyanide – 47, 113, 194, 248
Hydrogen peroxide – 263
Hydrogen sulfide – 25
Insecticides – 341
Iso-butanol – 53, 162, 312
Iso-butyl acetate – 53
Isobutylene – 122, 123, 373
Isobutyraldehyde – 312
Isocyanates – 192
Iso-octyl alcohol – 122, 152, 291
Isophthalic acid – 290
Isoprene – 214
Isoprene dicyclopentadiene – 122
Iso-propanol – 45, 122, 123, 162, 352, 378
Isopropanol amines – 110
Isopropyl acetate – 123
Isopropyl benzene – 110, 214
Isopropyl chloride – 110
Isopropyl, 2,4-dichlorophenoxyacetate – 42
Isopropyl ether – 122
Ketones – 49, 357
Latex – 111, 129
Lindane – 124
Lindane trichlorobenzene – 104
Maleic anhydride – 48, 242
Metallic naphthenates – 290
Methanol – 7, 53, 54, 59, 60, 81, 116, 162, 194, 285, 313, 345
Methionine – 114
Methyl butyl ketone – 162
Methyl cellulose – 110
Methyl chloride – 12, 105, 107, 111
Methyl chloroform – 111
Methyl ethyl ketone – 54, 123, 162
Methylal – 53
Methyl amine – 115
Methylene chloride – 12, 105, 107, 111
Methyl mercaptans – 321
Methyl propyl ketone – 162
Methyl styrene – 156
Methyl vinyl pyridine – 227
Miticides – 101
Morpholine – 171
Muriatic acid – 105
Naphthas – 371
Naphthalene – 214, 217, 230
Naphthenic acids – 123, 149, 290, 305, 310
Nitric acid – 28, 121, 178, 179, 191, 204, 209, 225, 285, 286, 287, 294
Nitrogen solutions – 43, 95, 225, 250, 294
Nitrogenous fertilizers – 100, 121, 178, 204, 334, 359, 372
Nitroparaffins – 80, 81
Nonyl phenol – 171
Nylon and intermediates – 56, 116
Oil treating chemicals – 342, 343
Olefin concentrate (C_7) – 293
Orthoxylene – 290
Oxides – 49, 197, 357
Para-cresol – 158
Paraffin solvent – 103
Paraformaldehyde – 53
Para-tertiary-butyl benzoic acid – 258
Paraxylene – 97, 167, 221, 278, 289, 290
Pentaerythritol – 156, 160, 236, 345, 357, 376
Perchloroethylene – 62, 103, 107, 111, 303
Perchloroethylene latices – 364
Pesticides – 101, 104
Petroleum polymers – 341
Petroleum resins – 97, 215, 276, 341
Petroleum waxes – 346
Phenol – 2, 158, 193, 230, 236, 245, 290, 352
Phenol-cresol blends – 187
Phthalic anhydride – 290
Piperline – 214
Plasticizers – 48, 49, 55, 291
Polybutadiene – 133
Polybutadiene-acrylonitrile type acyclic elastomers – 127, 159
Polybutadiene-styrene type acyclic elastomers – 127
Polybutene – 212, 290, 291
Polyesters – 192
Polyethylene – 13, 44, 46, 47, 48, 49, 116, 147, 177, 194, 197, 288, 312, 360, 362
Polyethylene glycol tert-dodecylthioether – 255
Polyglycol – 110, 111, 208
Polyglycol ethers – 110
Polyisobutylene – 97, 123
Polystyrene – 108, 109, 175, 364, 370
Polyvinyl chloride – 110, 121, 273
Polyvinyl chloride resin – 103
Polyvinylidene chloride – 110
Propanol – 53, 162
Propionaldehyde – 162
Propionic acid – 54, 162
Propyl acetate – 53
Propylene – 11, 150
Propylene dichloride – 110, 111
Propylene glycol – 53, 110, 111
Propylene oxide – 53, 110, 111
Propylene tetramer – 122, 167, 212, 304, 305, 306, 307, 310
Propylene trimer – 122, 167, 212, 305
Rubber accelerators – 213
Rubber base paint – 133
Rust preventives – 13, 382
Sodium carboxy-methyl cellulose – 350
Sodium cresylate solutions – 183
Sodium nitrate – 209
Sodium sulfide – 187
Sodium sulfite – 283
Sodium sulfhydrate – 187
Solvents – 53, 233, 256, 258, 264, 280, 357
Styrene – 24, 48, 110, 111, 133, 215, 257, 260, 364
Styrene monomer – 130, 175, 194, 373
Styrene oxide – 111
Styrene resins – 145, 184, 185
Sulfonated alkyl benzenes – 234, 235
Sulfonates – 30, 90, 195, 203, 216, 265, 277, 280, 284, 290, 305, 310
Sulfur – 22, 77, 131, 150, 151, 152, 153, 154, 169, 172, 206, 207, 224, 226, 231, 253, 254, 268, 270, 271, 272, 278, 280, 292, 296, 298, 314, 318, 319, 320, 321, 344, 348, 358, 375, 377
Sulfuric acid – 3, 4, 18, 83, 84, 85, 178, 193, 204, 300, 301, 302, 334, 368
Synthetic detergents – 5, 18, 19, 92, 350
Synthetic lubes – 195
Synthetic resins – 236, 237, 238, 239, 240, 241, 242, 243, 244
Synthetic rubber – 16, 96, 122, 128, 129, 140, 141, 143, 144, 167, 223, 260, 315, 328, 335, 373
Synthetic rubber (nitrile) – 137, 138, 145, 337
Tert-dodecylmercaptan – 255
Terylene – 361
Tetra-ethyl pyrophosphate – 42
Tetraethylene glycol – 111
Tetrahydrofurfuryl, 2, 4, 5, –trichlorophenoxyacetate – 42
Thiophene – 170
Toluene – 92, 97, 111, 148, 167, 217, 232, 246, 249, 257, 266, 267, 268, 278, 289, 292, 305, 341, 371
Trichloroethylene – 111, 364
Trichloromethylmercapto-4-cyclohexene, 1, 2-dicarboximide – 42
Tricresyl phosphate – 55
Tridecyl alcohol – 122
Triethylene glycol – 111, 208
Trioxane – 53
Urea – 6, 7, 61, 98, 146, 261, 294, 317, 333
Vinyl acetate – 54
Vinyl chloride – 103, 111, 194, 273
Vinylpyridine type acyclic elastomers – 133
Vinyl resins – 47, 49, 213
Vinyl toluene – 110
Vinylidene chloride – 111
Wetting agents – 49
Xylenes – 97, 148, 167, 217, 232, 246, 266, 267, 278, 290, 292, 305, 341, 371



Insulcolor . . . *tough plastic finish protects and color codes insulated lines and tanks*

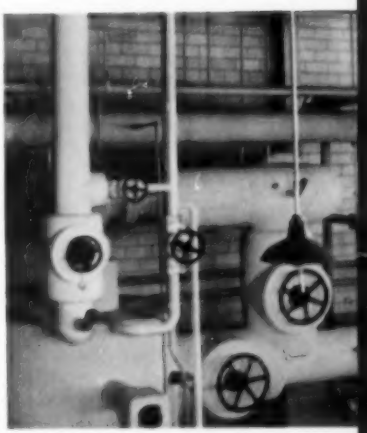
On both indoor and outdoor installations, you can be sure of long-lasting protection with this rugged insulation finish. And the durable plastic Insulcolor® coating not only protects insulated lines, tanks, vessels, ducts, and cold rooms, but serves as color identification, too.

Available in a choice of seven colors and white, Insulcolor furnishes a smooth, good-looking finish. It will withstand a wide range of temperatures and severe outdoor conditions without cracking, crazing, or peeling. Bumping or abrasion will not damage Insulcolor's tough plastic surface, and Armstrong Insulcolor is both fire resistant and moisture resistant, too.

Insulcolor is quickly and easily applied by brush or spray gun. An application lasts many years with little or no maintenance. Dirt, grease, and soot are readily washed off the smooth Insulcolor surface.

One of many products developed by Armstrong Research for the industrial insulation field, Insulcolor is readily available through the Armstrong Contract Service. Get full details on Insulcolor and the Armstrong Contract Service from your nearest Armstrong office. For your copy of the free 32-page booklet, "Armstrong Industrial Insulations," write today to Armstrong Cork Company, 209 Stratton Street, Lancaster, Pennsylvania.

Armstrong INDUSTRIAL INSULATIONS



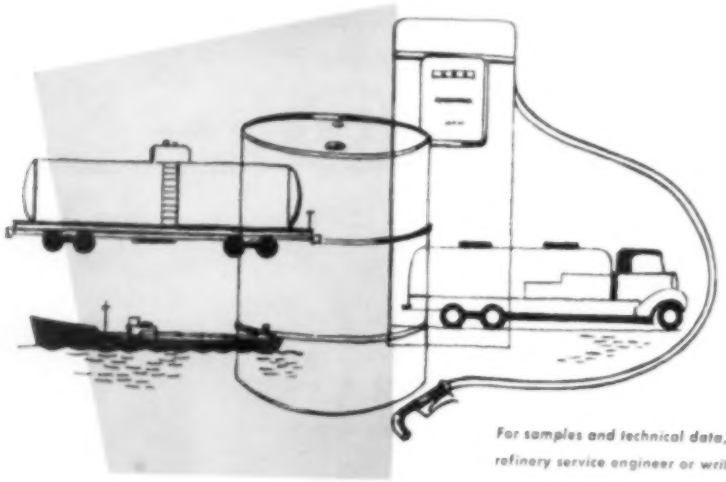
Because Insulcolor color codes, as well as protects, it eliminates the bother and expense of stenciling or painting insulated lines with an identifying color after the finish has been applied.

KUPLEX
METAL DEACTIVATOR

A New Tretolite Company product

INSURES BETTER, MORE STABLE REFINED PRODUCTS

Copper contamination of refined products can result from as little as 0.028 mg. of copper per gallon. Copper contamination often results from copper treating, but flow through copper or copper alloy equipment also can result in potentially harmful contamination. Further sources of contamination, pipelines, pumps, tubing and fittings can contribute to copper contamination even after the hydrocarbon product has left the refinery for distribution. Kuplex offers the refiner a method of product quality protection at a minimum cost. Kuplex nullifies, by a chelating action, the catalytic degenerative oxidation caused by copper in hydrocarbons. Especially applicable to gasoline, Kuplex is also effective in hydrocarbon streams such as kerosine, jet fuel, diesel and burning oil, turbine oil and greases.



For samples and technical data, ask your Tretolite refinery service engineer or write to

TRETOLITE COMPANY

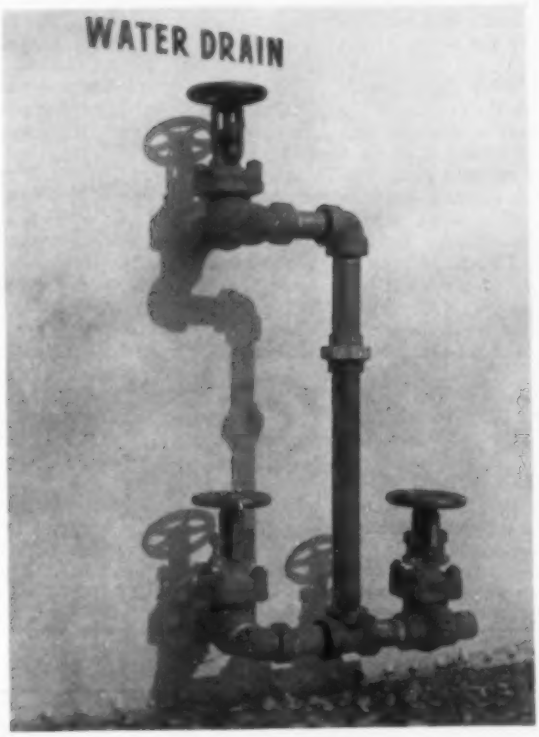
A DIVISION OF PETROLITE CORPORATION

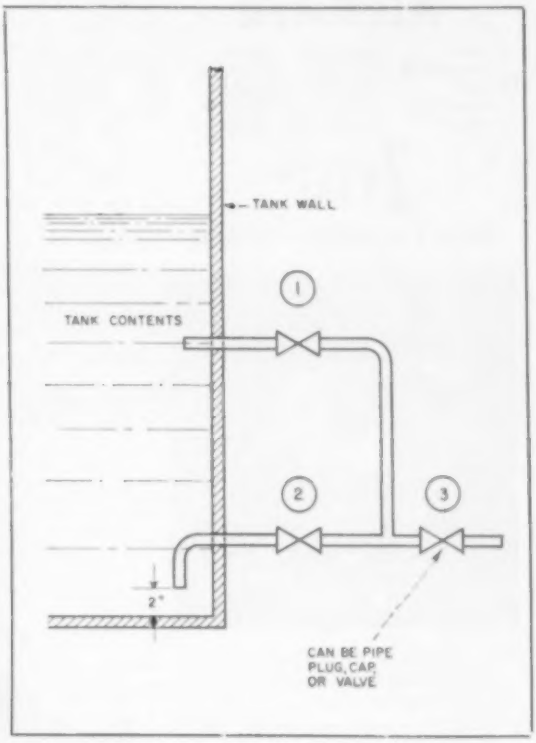
369 Marshall Avenue, St. Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California

Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION PREVENTIVES • SCALE INHIBITING
ASPHALT ADDITIVES • FUEL OIL ADDITIVES • WATER DE-OILING • PARAFFIN
REMOVAL • PRODUCTION STIMULATION • BACTERICIDES • METAL CONDITIONERS

KU-3





WATER IS FLUSHED OUT OF DRAWOFF LINE arrangement shown above to prevent freezing in cold weather

Cold Weather Drawoff Won't Freeze

ARE you plagued by storage tank water drawoffs freezing during sub-zero weather? Socony Mobil Oil Co.'s refinery at East Chicago, Ind., had so much trouble during winters that they developed their freeze-proof "East Chicago" water drawoff.

The three-valve system, shown in the photograph above, is simple to operate. When withdrawing water from the storage tank during cold weather, valves 2 and 3 (see drawing above) are opened and the desired amount of material is drained from the tank through the drawoff arrangement.

When through draining the tank, valve 3 is closed and valve 1 is opened, thus forcing oil (or gasoline) from the tank down through the drain line and purging the water through valve 2 and into the storage tank.

To purge water from the line to and past valve 3, valve 2 is closed and valve 3 opened momentarily until oil (or gasoline) comes out of the drain—then valve 3 is closed.

Now water has been removed from the drain system exterior to the tank, and valve 2 is closed. The water-purged system is freeze-proof, ready for cold weather.

Valve Gland Repaired Onstream

THE packing gland on the hot (about 1000° F.) regenerated catalyst line slide-valve of a Fluid cracking unit began to leak about a year ago at the Big Spring, Texas, refinery of Cosden Petroleum Corp. Those familiar with this type of valve will realize that it is not possible to repack one without shutdown or touch it without risking a severe burn.

It was evident that the purge-air valve to the slide valve stem had become plugged with catalyst, in turn allowing catalyst to build up in the slide valve until it had eaten away the packing. Allowed to continue, the leaking catalyst could seriously weaken the slide valve stem itself and eventually cause an emergency shutdown long before regular turn-around time was scheduled.

It was decided to attempt an emergency repair to avoid the loss of time and money resulting in even a few hours shutdown of the whole unit.

The maintenance shop blacksmith believed that a split-type external packing gland could be installed which

would stop the leak. Then, if purge air flow could be re-established, the leaking slide-valve could "limp along" until regular turnaround unless the slide-valve stem already was too seriously weakened by the action of the catalyst.

First, two half-inch high-alloy studs were arc-welded to the outside of the leaking gland along a diameter and on opposite sides of the slide-valve stem. These were oriented parallel to the stem and each other. They were about 3-in. long. (The smith aligned them by eye, incidentally, sighting around the body of the valve.)

A new gland packing follower was made from inch-thick high alloy plate. A circular piece was cut out, approximately the same diameter as the original packing follower, drilled in the center to provide clearance for the stem, and two bolt holes drilled along a diameter to fit the studs welded to the original gland packing follower for the slide-valve. The center-hole was reamed about half the thickness of the follower to form a cup-shaped depression to accommodate new packing.

The new follower was then split along the diameter on which the bolt-holes were drilled to allow it to be installed on the slide valve. Near the bolt-holes on each "side" two holes were drilled into the two halves and tapped to take small bolts. The latter were to draw the two halves of the follower together after installation.

The split-type follower was assembled on the slide-valve, packing placed in the depression, and then drawn down onto the face of the leaking packing follower. The leak was stopped immediately.

Meanwhile, the purge-air line to the slide-valve had been disconnected at the valve, and a drill inserted to remove the plug. This was successful and purge air was returned to the valve. This eventually removed the catalyst which caused all the trouble.

The emergency packer has functioned satisfactorily now for nearly a year, much longer than the anticipated requirement. The Fluid unit turnaround has been postponed because of operating demand and since external inspections have indicated no pressing need for it. This run may yet set a world record for length. Thus the life of this emergency repair is still undetermined.

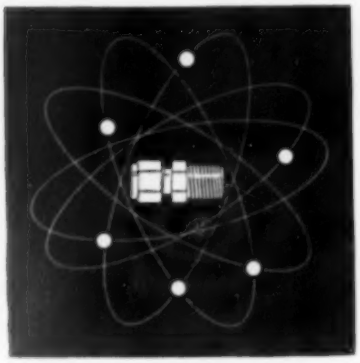
SLIDING DOOR shows principle of gasket storage rack

'Sliding Door' Gasket Rack Saves Space

A GASKET rack has been developed for use in the storehouse at the Esso Standard Oil Co. Bayway Refinery, Linden, N. J. Unistrut, a lightweight mechanical support, has been combined with "Masonite Pegboard" to make a sliding vertical rack. The Pegboard is covered by ¼" holes on 1" centers. It is possible to fit many different shapes and sizes of gaskets into the same general area. Space has been conserved by supporting the boards overhead by a trolley attachment. By pulling the boards out into a center aisle, you can store gaskets on both sides. The rack units have a total of 7,680 square feet of storage area.

More Plant Practice Tips on page 1432 ▶ ▶ ▶

NOW Swagelok®
TUBE FITTINGS FROM
ALUMINUM
TO Brass, Carpenter 20, Gold, Hastelloy, Inconel, Monel, Nickel, Platinum, Silver, Stainless Steel, Steel, Tantalum, Teflon, Titanium, Zirconium
ZYTEL*
POLYAMIDE RESIN



From aluminum to "Zytel" there's a Swagelok answer to your fitting problems. The new Swagelok Tube Fittings of "Zytel" are for use with plastic tubing in applications where corrosion is a problem. They are the first to be made in a complete range of shapes that include elbows, tees, reducers and adapters.

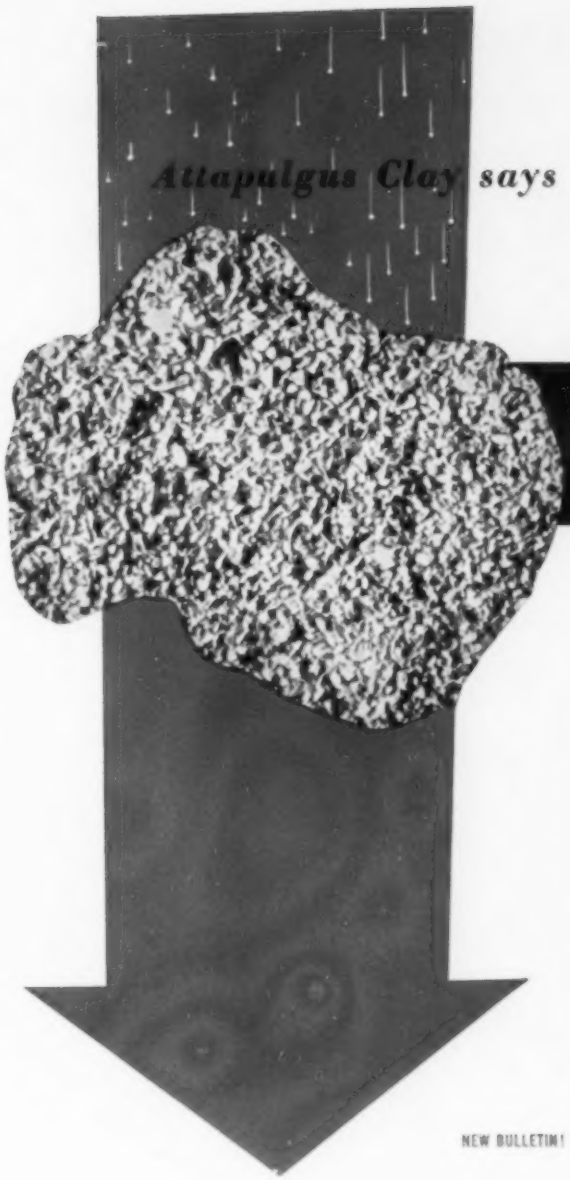
The new Swagelok Tube Fittings of "Zytel" are made to the unique Swagelok patented design that provides strong, torque-free and leakproof joints at all tubing connections. Sleeves or inserts are unnecessary. Specify Swagelok for every fitting need and eliminate unnecessary fitting problems.

FREE: For complete information write for the Swagelok catalog. Address Dept. D4

Swagelok Tube Fittings Are
Easy to Use
No Special Tools Needed
No Flaring or Threading

*DuPont trade-mark

CRAWFORD FITTING CO.
884 E. 140th Street
Cleveland 10, Ohio



Attapulgus Clay says **STOP!**

to
Platinum Catalyst
poisons

Attapulgus Clay keeps strict watch over your catalytic reforming feed stocks, protects you against losses caused by catalyst poisoning. It does this by effectively reducing the detrimental constituents that temporarily (sometimes permanently) foul the catalyst.

Here are the troublemakers (some need only be present at 10 parts per billion) that Attapulgus Clay adsorbs from the stream: ARSENIC—either present in the crude, or picked up from corroding tubes and equipment; LEAD—either crude-occurring or picked up; SULFUR—alkyl or aryl; NITROGEN—known to exist in some crudes, but whose source usually is in amine-type corrosion inhibitors.

Setting up this effective clay treatment safeguard can be accomplished at a surprisingly low investment—one that pays out promptly in terms of the most favorable production rate.

This is another solid example of how M&C products keep growing in value to refiners. There's always a *new place* for these versatile minerals to improve the quality and cut the processing costs of petroleum products.

NEW BULLETIN! "Preparation of Petroleum Feeds for Platinum Catalysts"

is just off press. Check the coupon for prompt mailing of your personal copy, and for other assistance, if desired.

ATTAPULGUS **ATTAPULGUS PRODUCTS** *from*

MINERALS & CHEMICALS CORPORATION OF AMERICA
210 W. WASHINGTON SQUARE, PHILADELPHIA 5, PA.

ALWAYS A BETTER WAY . .

MINERALS & CHEMICALS CORPORATION OF AMERICA
Dept. D, 210 W. Washington Square, Philadelphia 5, Pa.

☐ Please send me "Preparation of Petroleum Feeds For Platinum Catalysts"

☐ I'd like to talk to a representative about a specific feed stock problem.

name _____ title _____

company _____

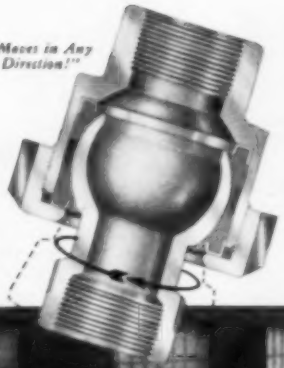
address _____

city _____ zone _____ state _____

 (To obtain more data on advertised products see page 1472)

BARCO *Flexible* BALL JOINTS

"Moves in Any Direction!"



UNLOADING ACID—This 2" flexible unloading line for acid tank cars is made with the aid of two Barco Ball Joints in stainless steel with No. 11CT gaskets.

When you need *movable* joints in piping handling

PETROCHEMICALS

Leading manufacturers of all kinds of chemicals recommend use of BARCO BALL JOINTS wherever you must provide for *flexibility* or *movement in piping*. Here's why:

Barco's Bar-Ductile metal ball and casing offer good resistance to chemical action and corrosion. Where additional protection is desired, these parts can be supplied in **stainless steel** or virtually any alloy specified.

Barco's new No. 11CT gaskets are impervious to chemical action and maintain a tight seal without interfering with the easy turning action of the joint. No lubrication is required.

One Barco Ball Joint will do the work of two or more swivel joints because it *"moves in any direction."*

Barco Ball Joints can help you in many ways. Use them in your plant! Barco also makes revolving joints (for continuous higher speed rotation), swivel joints, and swing joints for other kinds of pipe movement. For complete information, write BARCO MANUFACTURING CO., 559K Hough Street, Barrington, Illinois.

QUICK FACTS

1. **NO METAL-TO-METAL CONTACT BETWEEN MOVING PARTS.** An important Barco advantage where corrosive chemicals are present, either externally or internally.
2. **CHEMICALLY INERT GASKETS.** Barco offers a choice of seven types of gaskets including No. 11-CT for corrosive service. No lubrication required.
3. **STAINLESS STEEL BODIES.** Also regularly furnished in Bar-Ductile metal, Steel, Bronze, Aluminum. Other special and alloy joints to order.
4. **MAXIMUM FLEXIBILITY.** Up to 40° side flexibility with 360° rotating movement.
5. **PRESSURE SAFE! FIRE-PROOF!** Unequalled for SAFETY where flexible connections are required.
6. **MANY STYLES AVAILABLE.** Angle or straight; threaded or flanged connections. For pressures to 7,500 psi; temperatures to 1000° F. 15 different sizes. ⅛" to 12".

• ASK FOR NEW BULLETIN No. 215-B

BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS

FIELD GASOLINE SUPPLIES can be moved easily on wheeled trailer mount shown in the photo above

Portable Gasoline Tanks Aid Field Operations

OFTEN a supply of gasoline is needed at field locations where permanent facilities are not available, or it is not desirable to install lines due to the transient nature of the immediate operation.

Applications for portable gasoline supply tanks include well pumpers, gasoline driven welding equipment, gasoline driven mobile equipment (not including vehicular equipment due to fuel tax complications), and miscellaneous gasoline equipment in temporary service.

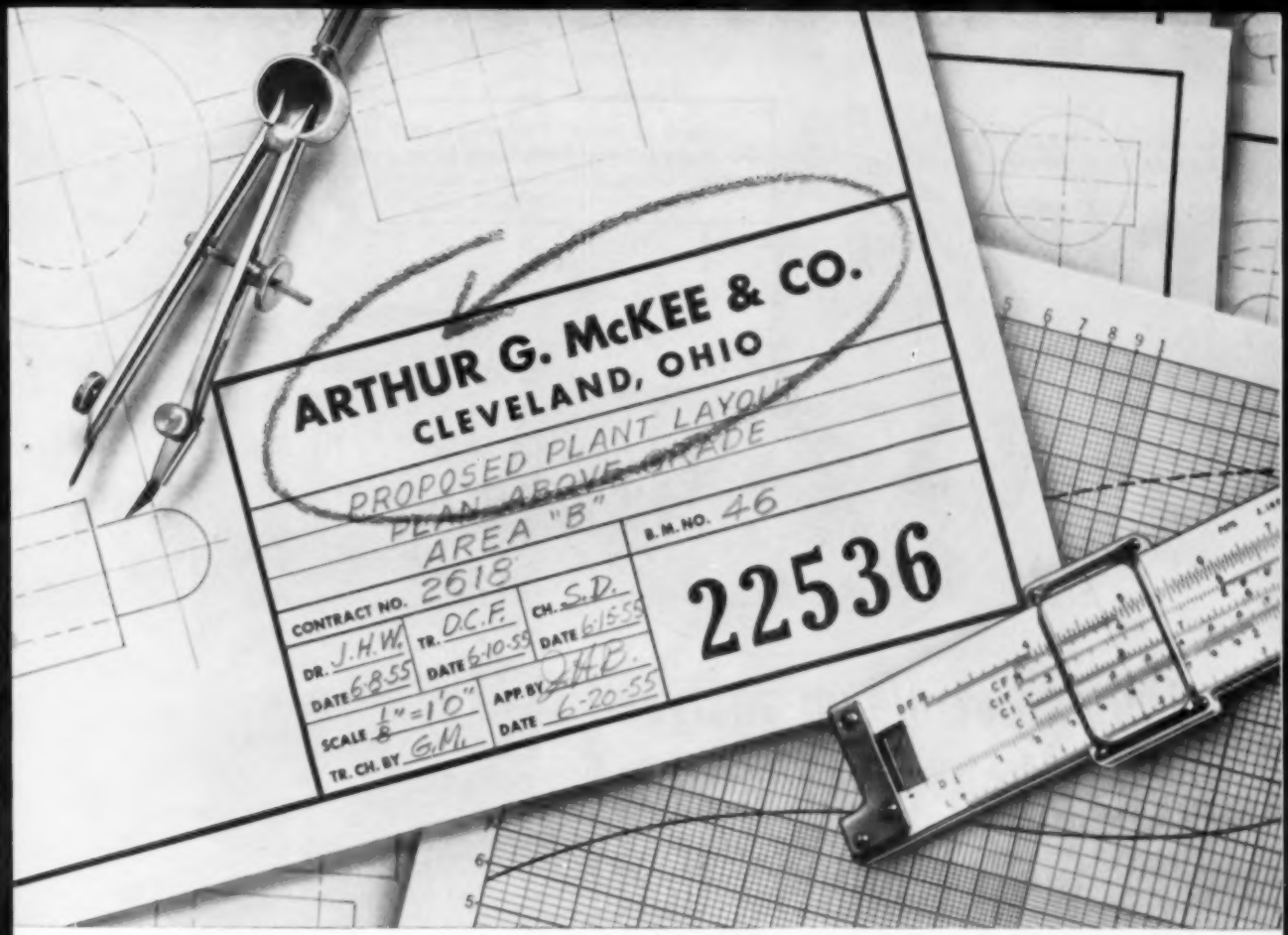
To meet this need, Socony Mobil Oil Co.'s East Chicago, Ind., refinery has made two adaptations of standard 275 gal. household fuel tanks.

Both adaptations are horizontally mounted, one style on skids, the other on two-wheeled trailers. Both styles have a large accessway on the top into which equipment fuel lines are inserted. Both also have small hand pumps mounted at one end for obtaining small quantities of gasoline for other miscellaneous uses.

The trailer mounted gasoline tank can be conveniently pulled by small vehicles. The skid mounted tank has lugs on each side so that it may be lifted and hauled by a load lugger or crane, or placed onto a truck bed.

Are You Hep?

Are you keeping a file of PETROLEUM PROCESSING Plant Practice Tips? Many refinery men do and find them to be valuable reference material.



THE BEST NAME YOU CAN GET
on the engineering of your new plant

Compared to the cost of material and construction, the engineering of your new plant represents a small percentage of your investment. Yet the erected value of your plant depends largely on the quality, accuracy and thoroughness of the engineering.

Here at McKee we know from sound, practical experience—a full half-century of it—that meticulous care in engineering pays off in reducing construction man-hours and in making most advantageous use of materials. But, most of all, McKee engineering assures you *correct* plant design and efficient layout—in short, a plant designed and built to earn a profit. When you want the best name you can get on your plant engineering, call in McKee:

50th ANNIVERSARY

McKee Engineering Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York, N. Y. • Union, New Jersey • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

sulfur in petroleum analyzed
better than twice as fast with Lindberg Unit!

This new Lindberg High Frequency Combustion Unit has been developed to provide a much more *rapid* analysis of sulfur in petroleum products. The unit is now being used by major refiners all over the country.

Its flexibility and speed make possible its application to a wide variety of petroleum products with boiling points above 300° F. including diesel fuel, kerosene, oil sludges, lubricating oils with additives, tars and asphalt.

Compact: This unit is conveniently compact, requiring a minimum of laboratory space.

Ready: Unit always ready for instant use. Only once-a-day warmup (just 57 seconds).

Cool: Only the samples are heated. There is no excess heat in laboratory.

Economical: "Vycor" glass combustion tube costs half as much, lasts longer and permits easy visibility.

Laboratory Supply Dealers can now make early shipments of this new Lindberg LI-500P "H-F" Combustion Unit. Write for bulletin No. LEP-1, or get in touch with your dealer for this and other quality Lindberg Laboratory Equipment.

G-10 3000° Furnace

H-2 Hot Plate

H-88 Hot Plate

B-6 Box Furnace

LINDBERG LABORATORY EQUIPMENT

Laboratory Division, Lindberg Engineering Co., 2481 West Hubbard St., Chicago 12, Ill.

RUBBER TESTING LABORATORY at Phillips Chemical Co. Philblack plant, Borger, Texas. The mill in the left foreground is used for mixing the synthetic rubber recipes. Storage cabinets line the wall at the right

Try Air-Conditioning . . .

For Better Synthetic Rubber Tests

By J. B. O'BRIEN*

LABORATORY testing of synthetic rubber samples has been greatly simplified by Phillips Chemical Company at their Philblack Plant, Borger, Texas, by maintaining standard air conditions in the Rubber Evaluation Laboratory.

In this room—shown above—small batches of synthetic rubber, compounded according to Government formulas, are subjected to various tensile, viscosity, abrasion and hardness tests to determine the quality of the carbon black produced at this plant. On the basis of these tests carbon black production is accepted, or recycled, or adjustments are made.

Synthetic rubber is extremely susceptible to small variations in the surrounding air temperature and relative humidity. A few degrees difference in air temperature significantly affects stress values, tensile strength and ultimate elongation. A two percent variation in the sample's moisture content, possible with a few percent increase or decrease in the rooms relative humidity, will change tensile strength 200 to 400 psi.

Test results would thus vary widely throughout the country. The Government has, therefore, established optimum values for each test, for each synthetic rubber compound. These values were obtained by testing samples at 77° F. Correction factors, such as those shown in the table, are then used throughout the country to compare test results, obtained under varying atmospheric conditions, to the values at standard conditions.

To simplify their test procedures, eliminating to a large degree the margin of error, Phillips Chemical installed a humidity conditioning system to maintain their laboratory at 77° F. ±3° F. and 35% R.H. The temperature tolerance, a 6° spread, in its affect on test results, is within tolerances allowed by the Government standards.

Temperature readings after each test and the use of the correction factors are no longer necessary. Considerable time savings have been obtained. The time lag between production, sampling and necessary adjustment of production has been shortened.

Test Procedures

In the laboratory, carbon black, polymers from Phillips' nearby copolymer plant, zinc oxide, sulphur, oils and other chemicals, are compounded according to established formulas into synthetic rubbers. The mill in the background of the above photograph is used for this purpose.

Prior to use, each of these components has been aged overnight in the room to come to an equilibrium temperature and moisture content. Because of this aging at standard conditions, it has been found that the test results of this laboratory have remained consistent whereas those of other unconditioned laboratories vary widely.

After being thoroughly mixed, a portion of each batch is made into the

* Mr. O'Brien is an Application Engineer for the Kathabar Div. of Surface Combustion Corp. of Toledo, Ohio.

form of wheels, slabs and pellets. The wheels, after a 45 minute cure, are used in the abrasion tests. The results of these tests would, for example, indicate the presence of grit in the pelletizer, poor refractories in the reactor or the use of too heavy oil.

The pellets, also given a 45 minute cure, are subjected to compression and hardness tests. The effect of rate of cure, excessive heat in the pelletizer causing oxidation and a presetting of the bonds in the rubber, etc., are found by these tests.

Tensile strength, ultimate elongation and stress at 300% elongation are determined in the test machine, shown in Fig. 1. The slabs used are given various cure rates, 25, 50 or 100 minutes depending upon the formula.

The results of these tests are interrelated. Abrasion values, for example, increase as the stress values decrease. A complete series of tests thus clearly indicate the quality of the carbon black and whatever adjustments in production are necessary.

Air Conditioning System

The air conditioning system used at Borger combines chemical-type dehumidification and a simple arrangement of heating and cooling coils. A schematic flow diagram, based on maximum design requirements, is shown in Fig. 2.

The Kathabar package unit, shown in cutaway, Fig. 3, subdehumidifies

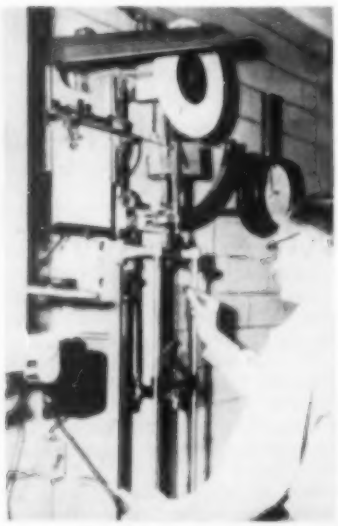


Fig. 1—**TESTING OF A SLAB SAMPLE** of synthetic rubber for ultimate elongation, tensile strength and stress value at 300% elongation

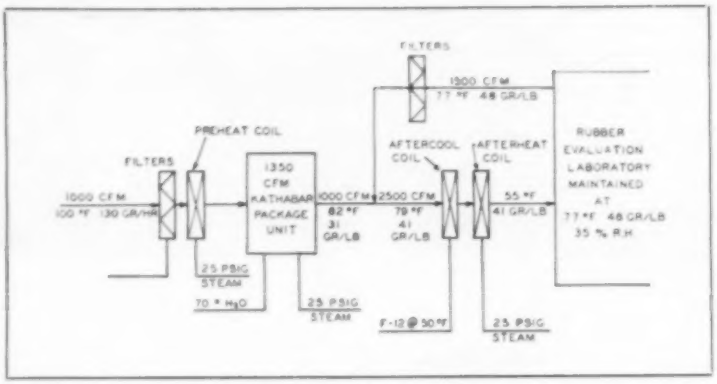


Fig. 2—**AIR CONDITIONING SYSTEM** flow diagram of laboratory system at Borger, based on maximum design conditions

1000 cfm of outside air, offsetting the entire 8850 Btu per hour, latent or moisture load of the laboratory. This unit employs as its dehumidifying medium, a chemical solution called Kathene. The principal constituent of this solution is lithium chloride, a chemical salt.

A lithium chloride solution, at a set density, will absorb moisture from a contacting air stream to an extent inversely proportional to the solution temperature. The temperature of the solution is automatically regulated by the temperature and rate of flow of the coolant used in the coils of the contactor section. Water at 70° F. is all that is required in this particular application to effect a reduction from 130 grains of moisture per pound to 31 grains.

Operation of the unit is completely automatic. The air to be dehumidified is drawn into the unit and brought into intimate contact with the absorbent solution. At the same time, both pass between the extended surface cooling coils. The excess moisture in the air is absorbed by the Kathene solution, which falls into the sump, and the air is exhausted to the distribution duct.

The solution is continuously recirculated back to the contactor section, and also 10 to 15% is circulated to the regenerator section. When the solution in the sump reaches a certain dilution, low pressure steam is put through the coils in the regenerator chamber. This action heats the solution sprayed there, forcing it to give up the absorbed moisture. This moisture is entrained by a contacting air stream and purged to the outside. The reconcentrated solution returns to the sump.

The dehumidified air in the system

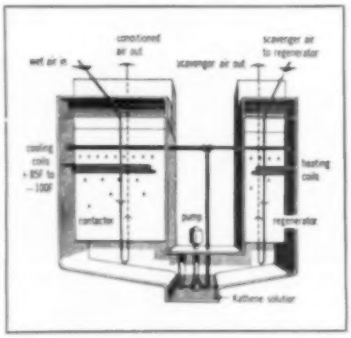


Fig. 3—**AIR DEHUMIDIFYING** unit cutaway drawing. The air washer or contactor chamber is on the left, the regenerator chamber on the right

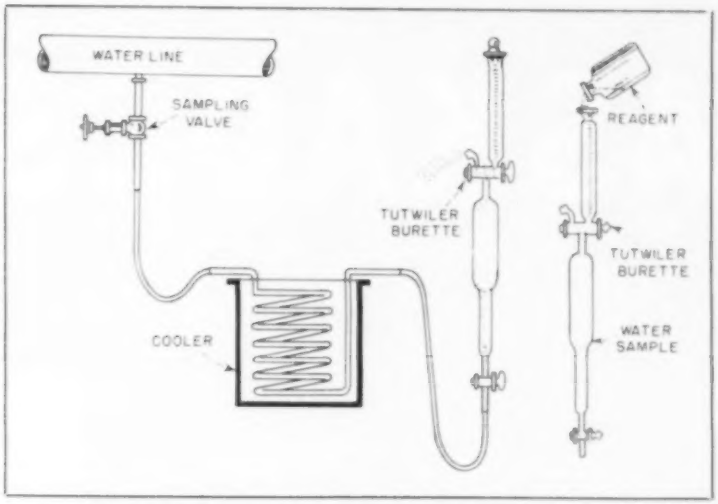
Temperature correction factors—testing of GR-S compounds

Temperature F.	Stress at 300% Elongation	Tensile Strength	Ultimate Elongation
55	0.96	0.82	0.91
60	0.97	0.86	0.93
65	0.98	0.90	0.95
70	0.99	0.94	0.97
80	1.01	1.02	1.01
90	1.03	1.10	1.05
95	1.04	1.14	1.07
100	1.05	1.18	1.09

at Borger, after it leaves the Kathabar unit, is mixed with 1500 cfm of air recirculated from the space. This mixture is cooled as necessary and delivered to the space at 55° F., 41 grains of moisture per pound. The two heating coils are used for winter operation.

The Kathabar units accomplishes this cooling using only 70° water. There is no sub-cooling and reheating. The water itself can be reused in other processes or can be recirculated as cooling tower water.

Maintenance on the system is very small. The Kathabar unit has only two moving parts, the solution pump and the regenerator fan motor. Solution concentration is automatically maintained and there is no loss or carryover of solution.



WATER SAMPLING and Reagent adding with Tutwiler burette

Tutwiler Burette Speeds Water Analysis

By THOMAS GARCIA B.*

The most generalized practical method to determine the dissolved oxygen content of water is Winkler's Method, which uses a special bottle, ground-glass stoppered, of 10 ml. capacity, as shown in the following drawing.

However, the use of pipettes and the special Winkler's Method bottle may be avoided by the use of a Tutwiler burette.

As shown in the drawing above, the "body" of the Tutwiler burette is used to secure the water sample—100 or 500 ml.—and the burette itself is used to withdraw the reagents—manganous sulfate, alkaline potassium iodide, and sulfuric acid—rinsing the burette with distilled water after each addition is made.

Once the sample is "fixed[1]," it is poured into a flask and titrated with N/100 sodium thiosulfate.

In our laboratories, Tutwiler burettes have proven easier to handle than the special Winkler's Method bottles.

(1) Betz, "Handbook of Industrial Water Conditioning," 4th edition, 1953, pp. 228-31.

STANDARD WINKLER'S Method bottle and sampling tube

* Mr. Garcia B. is Chief Chemist, Laboratories TUGN, Petroleos Mexicanos in Poza Rica, Veracruz, Mexico.

Aromatics Recovery
TENNESSEE'S
SO2
LIQUID SULFUR DIOXIDE

Efficient—Economical
SOLVENT

Liquid Sulfur Dioxide has proven itself as the efficient and economical solvent for the recovery of aromatics. It is completely miscible with aromatic hydrocarbons over a wide temperature range, while the solubility of napthene and paraffin hydrocarbons is limited and decreases with decreasing temperature. Recovery of a higher percentage is obtained.

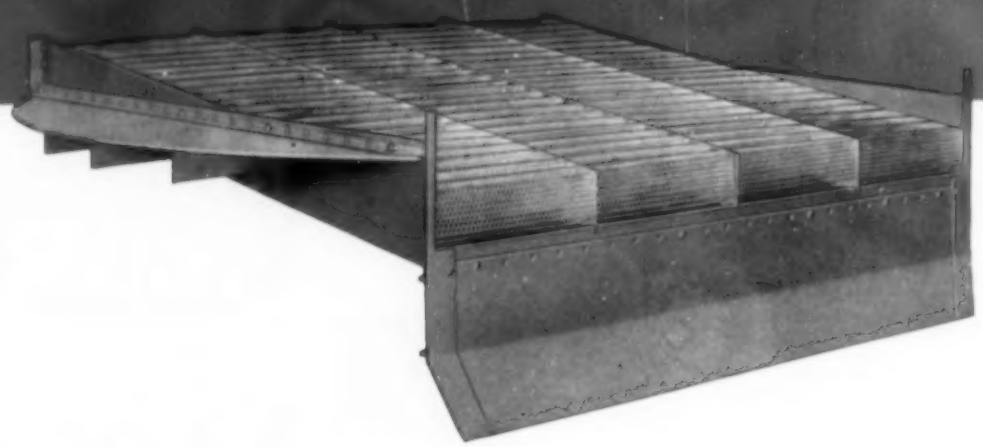
Tennessee's high quality Liquid Sulfur Dioxide can be effectively and economically applied to your operation. We would like the privilege of discussing this with you.

SULFUR-DIOXIDE SO2

Available in:
Cylinders, Ton Drums,
Tank Trucks and Tank Cars

TC
TENNESSEE CORPORATION
617-629 Grant Building, Atlanta, Ga.

"Extraordinary Performance Is Routine" with KASKADES



CASE HISTORY No. 1 . . .

One refiner was operating a 7.5′ vacuum tower which was limiting capacity and yields due to the pressure drop of existing bubble trays. Capacity desired was:

Vapor . . . . 24,600 #/hr of 0.0137 #/cf density
Liquid . . . . . 36,400 #/hr of 58.3 #/cf density

This refiner replaced the bubble trays with "Benturi" Kaskade trays on the same supports, and is now obtaining a pressure drop of less than 1.0 mm hg pressure drop per tray.

CASE HISTORY No. 2 . . .

An engineering firm recognized a pressure drop problem with a process duty equivalent to:

Vapor . . . . . 35,500 #/hr of 0.26 #/cf density
Liquid . . . . . 965,000 #/hr of 62.4 #/cf density

Yet, multi-pass "Benturi" Kaskade trays in a 7.5′ diameter column gave them less than 2.0 mm pressure drop per tray.

Whether your problem is extraordinary or routine, the design flexibility "Benturi" Kaskade tray is probably your answer to greater capacities and higher efficiencies. Wire, write or phone us on its application to your fractionating problem, there's no obligation.

KOCH ENGINEERING COMPANY, INC.

DESIGNERS • MANUFACTURERS • BUILDERS
321 WEST DOUGLAS • WICHITA 2, KANSAS

Tulsa, Oklahoma, Repr.
W. C. Myers Co.
Wright Building

Houston, Texas, Repr.
Alpha Engineering Company
P. O. Box 12371

Eastern Repr.
Crawford Engineering Company
295 Madison, New York, N. Y.

Pittsburgh, Pennsylvania, Repr.
D. D. Foster Company
501 Alcoa Building

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Diisocyanates

Diisocyanates, pronounced **"dye-eye-sew-sigh-**ah-nates," are chemicals usually derived from organic diamines and the "poison gas" known as phosgene. Since many diamines (chemicals containing two $-NH_2$ groups, N being nitrogen and H hydrogen) are derivable from petroleum, and since phosgene ($COCl_2$ where C is carbon, O oxygen, and Cl chlorine) can also be so prepared, some of the important diisocyanates come well within the category of petrochemicals.

In general, the diisocyanates are colorless, volatile liquids which have a penetrating odor. The isocyanate group (of which two are present) has the formula -NCO; thus tolylene diisocyanate, one of the commercial isocyanates, has the formula $CH_3{\cdot}C_6H_3(NCO)_2$.

While the diisocynates themselves have been known chemically for over 100 years, their potentialities did not begin to be realized until less than 20 years ago. During World War II they were used to prepare adhesives. In the past few years, however, they have been reacted with alkyd resins (polyesters), glycols, water, amines, and other materials containing at least two active hydrogens to yield long-chain polymers which can be vulcanized or otherwise treated to yield "urethane" synthetic rubbers, plastic films, or foamed-in-place plastics. These "polyisocyanates" or "polyurethanes" have exceptional strength and durability; their potentialities will be covered in a later item in this series.

Raw materials for the diisocyanates include petroleum hydrocarbons, ammonia (made from natural gas), and carbon monoxide (from partial combustion or the methane-steam reaction). If costs can be lowered, these chemicals may have fabulous futures.

Hydrogen

Hydrogen, pronounced **"high-**dro-jen," is a colorless, odorless, tasteless gas which is lighter than any other substance and is highly flammable. It is known to the man on the street as the "H" of "H_2O" (water) and as the gas the Germans used in their ill-fated dirigible, the Hindenburg. It is known to petroleum chemists as a material highly touted, a few decades ago, as the reagent for the high-pressure "hydrocracking" (destructive hydrogenation) of heavy oils and coal, to yield gasoline and middle distillates. And today it is known to the petroleum industry as a substance produced in large quantities during catalytic reforming (which involves dehydrogenation—removal of hydrogen), and as a chemical used in the synthesis of ammonia and the treating (mild hydrogenation) of naphthas, middle distillates, lubricants, and waxes to upgrade and purify them.

Until recently, these latter refining processes (and hydrocracking) were more or less uneconomic, because of the cost of hydrogen synthesis, purification, and compression to high pressures. Hydrogen was commonly produced, and still is, by treatment of "water gas" (mixtures of hydrogen and carbon monoxide, produced by the reaction of steam with coal or natural gas, or by partial combustion of the latter) with steam, followed by scrubbing with water to remove carbon dioxide; additional quantities are produced by the electrolysis of water, reaction of iron and steam, and the thermal decomposition of hydrocarbons.

Uses (alone, not in admixture with carbon monoxide) include the synthesis of ammonia, reduction of metallic ores, production of margarine and shortenings from vegetable oils, and countless chemical reactions.

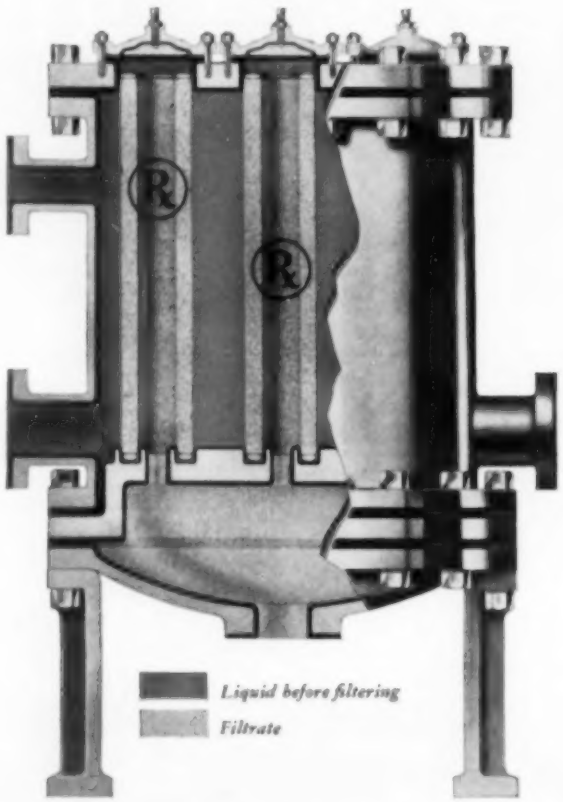
Today, however, the vast and increasing quantities of hydrogen produced in the catalytic reforming of naphthas are changing this entire picture. Hydrogen need no longer be produced at refineries; it is available there, relatively pure and at high pressures. It is for this reason that refinery units for hydrogen treating and ammonia synthesis are being announced in increasing numbers, and that other markets for hydrogen are being sought. Construction of more treating plants may eventually cause a shortage of supply, but for the immediate future excess hydrogen will probably be available at many refineries.

NEWS in VIEWS

FIRST IN THE PHILIPPINES—This new 26,000 b/d refinery, first one in the Philippine Islands, has just gone onstream at Bauan, Batangas, for Caltex. Operating on imported crude, the plant is running at about 50% of capacity. Low flat structure in center is administration building.

Another Norton ℞ *on the job!*

Outstanding performance of Adams filters aided by Norton seamless porous tubes



R. P. Adams Co. Filters, covering many chemical filtering services, deliver sparkling clear filtrate and insure quick cleaning without disassembly. Adams filters handling acid or neutral solutions are equipped with Norton seamless porous tubes, *engineered and prescribed* for faster, more thorough filtering and backwashing.

Besides assuring fast, thorough filtering action, Norton porous tubes are extremely easy to clean by backwashing. Here are several good reasons why they excel in these two primary essentials of efficient, economical filter performance:

- Norton porous tubes are made of ALUNDUM* (fused alumina) *engineered* by Norton for chemical stability, inertness and other properties necessary to withstand acid, neutral and slightly alkaline liquors.
- Like all Norton ALUNDUM porous mediums they are made with the patented *controlled structure* process that assures even distribution of pores — for uniform passage of both filtering and backwashing liquids.
- They are *seamless,* providing unobstructed diffusion over their entire area — for further efficiency in both filtering and cleaning.

Other big advantages

of all Norton porous mediums include ease of installation and exceptional resistance to breakage and chipping. Available in sizes and open-pore ratios to meet your needs, they're *engineered* to last longer and cut your operating costs — and they're *prescribed* for a wide variety of chemical services, such as filtering water or solvents . . . cutting oils, wine, etc. . . . reclaiming cleaning fluids and industrial waste . . . and for boiler feed water treatment, carbonation, chlorination and other gas diffusion applications.

See your Norton Representative for further facts or write, describing your requirements, to NORTON COMPANY, 268 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

NORTON

REFRACTORIES

Engineered... ℞ ...Prescribed

Making better products... to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

PERSONALS

Vernon A. Breitenbach has joined the Standard Oil Co. (Ohio) petrochemical department as assistant to the manager of the market and product development division. He began with Sohio as a junior engineer in 1947, was promoted to engineer in 1950, to senior engineer two years later, and transferred to process engineering as a group engineer early in 1955.

Breitenbach took both bachelor's and master's degrees in chemical engineering at the University of Rochester.

Allen Behn has been transferred from the Lima refinery to the petrochemical department's plant division as maintenance coordinator. Behn began with the company in 1947 as an engineer, then was transferred to Lima as a maintenance engineer two years later.

He earned a B.S. in mechanical engineering at the University of Wisconsin.

Jack A. Smith, formerly assistant chief chemist for Phillips Chemical Co., has joined the Sohio petrochemical department as chief chemist. He obtained a Bachelor of Science degree in chemistry from Abilene Christian College.

LION AND MONSANTO AGREE TO MERGE, and Charles Allen Thomas, president of Monsanto, left, and T. H. Barton, Lion board chairman, seal the agreement.

Dr. Myron H. Wilt has been appointed to the rubber chemicals section, the development department, of Monsanto Chemical Co.'s organic chemicals division. Wilt has been with the research department of the division working largely in the field of polymerization since he joined the company in 1952. He holds a Ph.D in chemistry from the University of Pittsburgh.

Robert M. Parks and **Earl L. Will** also have joined the development department of the organic chemicals division. Parks is assigned to the development of plasticizers and related products, replacing **Walter F. Waychoff,** who has joined the division's sales department.

Parks received a B.S. degree in chemistry from St. Louis University in 1949. He had been with Monsanto's research department before his latest appointment.

Will joined Monsanto in 1938, after his graduation with a B.S. in chemistry from the University of Chicago. He returned to the university during 1948-49 for graduate work. He has been in charge of the analytical laboratory at the John F. Queeny plant for the past nine years. His new assignment is in intermediates and exploratory chemicals.

Paul Zuris has been appointed mechanical engineering supervisor for Mobay Chemical Co., a subsidiary partly owned by Monsanto. Zuris received his bachelor's degree in mechanical engineering from the University of Michigan in 1939 and joined Monsanto as a maintenance engineer the same year. He was moved to organic chemicals a year later and appointed to the position of group leader of mechanical engineering in 1945.

Secretary of the Mobay firm is **John A. McNiff,** who was formerly with the New York law firm of Shearman, Sterling and Wright.

William F. Hering has been appointed engineering estimator of Mobay. He has been an estimator and control engineer for Monsanto's research and engineering division. He joined the company in 1945 and subsequently served as estimator, surplus equipment engineer, evaluation engineer and project control engineer.

Ashby J. Badger has been named to succeed E. S. Holt as president of the Utah Oil Refining Co. Holt has retired from active direction of the company, though remaining a member of the board of directors.

Badger is a graduate of the U.S. Naval Academy and joined the company as a salesman in 1939. His assignments have been in marketing and sales.

John Anderson, formerly research director at Shell Chemical Corp.'s Houston laboratory, has been appointed research director of a new group set up by the company to study the manufacture of synthetic rubber and related subjects. The research unit is at the Torrance, Calif., laboratory. Anderson received his B.A. from Georgetown College and his Ph.D from the University of Illinois. He was made director of the Houston laboratory in 1948.

Head of the group's chemistry section is **D. S. Melstrom,** who was head of the organic section of the Houston laboratory. **F. D. Moss,** supervisor of the experimental plants department of

Shell Development Co. in Emeryville, Calif., has been appointed head of the process and pilot plant section.

Product research is being led by **E. T. Bishop**, formerly of the organic and applications department at Emeryville. **L. R. Beason,** research chemist of the organic section at Houston, has been named group leader in the chemical section, and **W. L. Holmes,** research technologist at Houston, is a group leader in the process and plant section of the new unit.

V. L. Keldsen has been transferred from San Francisco, where he was manager of the production department in the ammonia division, to New York as a section leader in synthetic rubber, a new post in the manufacturing development department.

S. A. Ballard has been appointed an associate director of research for Shell Development at Emeryville. Ballard was formerly head of the petroleum refining department. His work is now in the market development, plastics and resins, and the polymer and chemical applications departments.

T. F. Leeds, assistant manager of alkylation, has succeeded **W. E. Hopkins** as lubricating oils assistant manager at Shell Oil Co.'s Wood River, Ill., refinery. Hopkins has left the company.

Leeds attended the University of Montana for two years, then transferred to the University of Detroit, where he received his bachelor's degree in chemical engineering in 1943.

He joined Shell the same year and worked as a technologist in several departments until 1951, when he became assistant alkylation manager.

Leeds has been replaced by **C. J. Cech,** formerly a technologist. Cech received a B.S. in chemical engineering from the University of Missouri in 1943 and began with Shell in 1946, after a term with Continental Oil Co. In 1948 Cech was transferred to the experimental laboratory, where he became a group leader. He worked next in the alkylation department and then in the technological department.

Jack W. Roach, vice-president of Deep Rock Oil Co., has been given the additional title of assistant to the president, in which capacity he will coordinate activities of the research and development department and be in charge of special projects assigned from the president's office. The first special project he has undertaken is to study the steps to be taken to increase the octane of gasoline that is manufactured in the company's refineries.

Robert M. Chesney, vice-president in charge of the Cushing refinery, has also taken charge of the Wynnewood refinery and has moved his office to Oklahoma City to discharge this new responsibility. Assets of the company have been purchased by Kerr-McGee Oil Co.

C. L. Case, Continental Oil Co., has become the 1955-56 president of the California Natural Gasoline Association. He has been with the organization since 1944 and served on the board of directors, the executive committee, the advisory committee—as chairman—and the technical committee.

Vice-president for the new term is **Raymond W. Todd,** Pacific Lighting Gas Supply Co. Todd was the recipient last year of the association's annual award for meritorius service in the group's behalf.

William C. Foster has become an executive vice-president of the Olin Mathieson Chemical Corp. Foster is the former president of the Manufacturing Chemists' Association and a onetime Deputy Secretary of Defense. He had been with the government nearly 11 years when he became MCA's president in 1953.

Mr. Foster

Among his government posts were Administrator for Economic Cooperation, Under Secretary of Commerce, and Deputy Administrator of ECA. Before entering government service Foster was president of Pressed and Welded Steel Products Co.

Robert E. Howe, formerly manager of the Sinclair Refining Co. refinery at Sinclair, Wyo., has been appointed assistant to the vice-president in charge of manufacturing, with headquarters in New York.

Howe is a graduate of the Colorado School of Mines and has been with Sinclair since 1934.

E. G. Hausner has been promoted from assistant manager to manager of the refinery, replacing Howe. Hausner's former post has been given to **Jack Corley,** formerly head of the technical department.

Frederick C. King has been promoted to manager of General Petroleum Corp.'s Torrance, Calif., refinery. In 1941, he was first employed as an inspector for the company's engineering department at Vernon. He became maintenance control engineer at the refinery in 1946 and three years later assistant manager of the engineering department.

King received his B.S. degree in chemistry from California Institute of Technology.

Mr. Brown

Dr. Brown

Richard F. Brown, general works manager of Spencer Chemical Co., has been appointed vice-president, with the same portfolio. Brown joined Spencer's predecessor, the Military Chemical Works, in 1942 as the ammonia plant supervisor and advanced through several positions. He became assistant to the vice-president in 1947 and subsequently served as chief engineer, general manager of research and development, and general manager of industrial services. He is a graduate of the University of Kansas.

Research and development activities at Spencer have been established in a separate division and **Dr. John R. Brown,** general manager of research and development, has been named managing director of the new division.

Brown, who is unrelated to the new vice-president Brown, began with Spencer in 1953. He had previously served as assistant director of the chemical division of what is now Esso Research and Engineering Co. and with two other firms.

Brown received his Ph.D. in chemical engineering from M.I.T.

J. C. Williams, formerly assistant superintendent of the Lockport, Ill., works of The Texas Co., has been promoted to process division supervisor at the company's New York headquarters. The new assistant superintendent at Lockport is **F. D. Davis,** who had the same job at the Casper, Wyo., plant.

The chief engineer at the Eagle Point, N.J., refinery, **W. E. Toms,** has been made the plant's assistant superintendent.

Another assistant superintendent at Casper, **V. K. Brandenburg,** has trans-

ferred to the West Tulsa plant, where he has the same title. His replacement at Casper, **C. T. Swan,** was formerly supervisor of operations at the Lawrenceville, Ill., plant.

Personals in Brief

Dow Chemical Co.

J. H. Means has become production manager for light hydrocarbon and polyhydric chemicals. Three new general superintendents were appointed: **A. C. Burkholder,** to light hydrocarbon chemicals, **R. H. Smith,** to polyhydric chemicals, and **T. E. Brown** to carbon tetrachloride and methyl chloride.

J. A. Skaggs has been promoted to superintendent of ethyl chloride, **D. E. Carey** to superintendent of perchloroethylene 2, and **L. G. Shelton** to assistant superintendent of vinyl chloride.

William P. Coker to lab supervisor of the organic process development laboratory.

R. L. Derby to superintendent of glycerine in the polyhydric chemicals unit. Other changes in the group are: **R. C. McClure** to superintendent of ethylene dichloride, **J. B. Paxton** to assistant superintendent of glycerine, **H. D. Sullivan** also to assistant superintendent of glycerine, and **K. C. Buchorn** to assistant superintendent of polyglycol.

In hydrocarbon chemicals these promotions have been announced: **D. C. Donaldson** to light hydrocarbon section superintendent, **E. H. Ivey** to superintendent of light hydrocarbon plants 1 and 2, **W. N. Milks** to superintendent of light hydrocarbon 3 and butadiene, **D. A. Rikard** to superintendent of light hydrocarbon 4, **G. H. Watkins** to superintendent of polyethylene, **J. L. Boyett** to assistant superintendent of light hydrocarbon 1, **H. McNair** to assistant superintendent of light hydrocarbon 2, **R. P. Metcalfe** to assistant superintendent of light hydrocarbon 3 and butadiene, and **A. J. Seidule** to polyethylene laboratory supervisor.

Assistant to the general superintendent of the gas and water department is now **J. W. Thurmond,** and **M. E. Sanders** has become superintendent at plant A, **L. C. Laycock** assistant superintendent at plant A, and **R. E. Daly** assistant superintendent at plant B.

W. L. Hendon has been promoted to superintendent of methyl chloride, **G. D. Heiniger** to superintendent of carbon tetrachloride, and **K. H. Oelfke, Jr.,** to assistant superintendent of carbon tetrachloride, succeeding Hendon. **Joervin Henderson** has been promoted to assistant superintendent of styrene finishing.

Humble Oil & Refining Co.

Alfred Moskowitz has been promoted to senior mechanical engineer in the design department, engineering division, of the Baytown refinery. He joined the company in 1943, after receiving a B.S. degree in mechanical engineering from Rice Institute.

W. O. Webber has moved up to technical specialist in the refinery's technical service division, where he will now work on process design of light ends recovery and processing facilities. Webber obtained his B.S. in chemical engineering from the University of Oklahoma in 1938 and began with Humble shortly afterward.

In research and development at Baytown, **S. H. Hastings** has been named research specialist. He holds a B.S. degree in chemistry from the University of Houston and an M.S. and Ph.D from the University of Texas.

J. C. Weisinger has been given the title of mechanical engineer in the design department of the engineering division. He has a bachelor's degree in mechanical engineering from Texas A. & M.

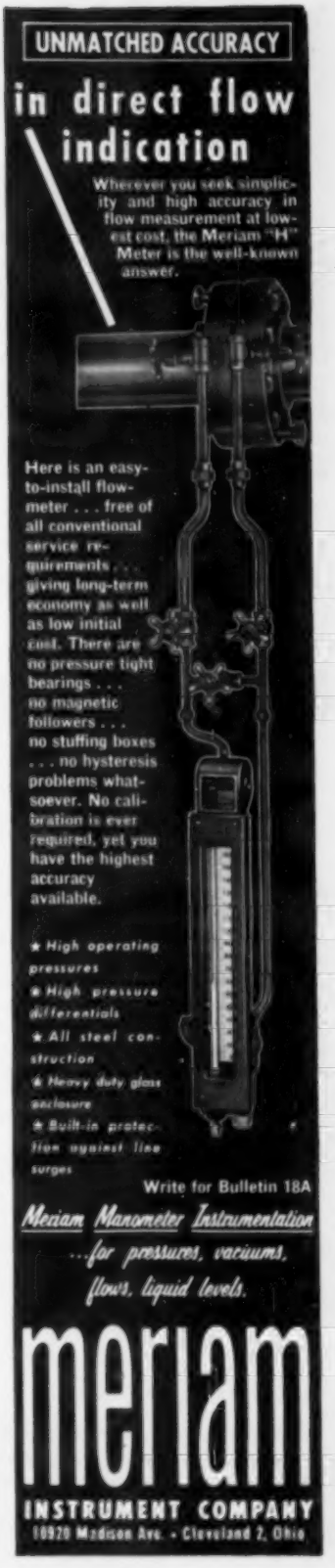
Industry Pioneer Dies

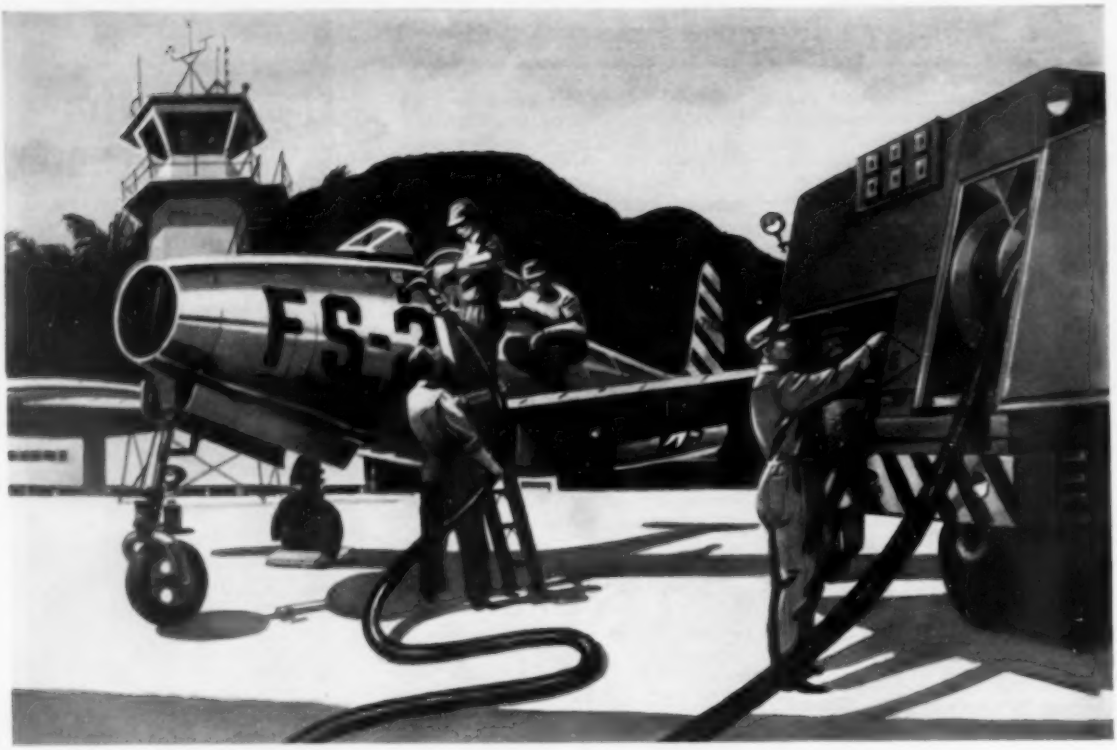
Edgar M. Clark, former vice-president and director of Standard Oil Co. (N. J.) and a co-inventor of the first successful cracking process, died July 31. He was 85 years old.

Clark began with Standard Oil of Indiana in 1890 as a shipping clerk and moved shortly afterward into refining, where he became an associate of Dr. William Burton. The two men worked together on the development of a cracking process and in 1913 their efforts resulted in the Burton pressure still, which revolutionized the refining industry.

Five years later Clark became general manager of Jersey Standard's Bayway refinery, and in 1920 a director of the firm. After the reorganization of the firm in 1927 he became president of what is now Esso Research and Engineering Co. and also president of the Esso Shipping Co. Three years later he was made a vice-president of Jersey Standard.

As president of the research company he was identified with the early development of the hydrogenation process in its application to oil refining. He also was one of the founders of the Ethyl Corp. After his retirement in 1933 he acted as an advisor to the company on pension and thrift plans.


UNMATCHED ACCURACY
in direct flow indication
Wherever you seek simplicity and high accuracy in flow measurement at lowest cost, the Meriam "H" Meter is the well-known answer.
Here is an easy-to-install flowmeter . . . free of all conventional service requirements . . . giving long-term economy as well as low initial cost. There are no pressure tight bearings . . . no magnetic followers . . . no stuffing boxes . . . no hysteresis problems whatsoever. No calibration is ever required, yet you have the highest accuracy available.
★ High operating pressures
★ High pressure differentials
★ All steel construction
★ Heavy duty glass enclosure
★ Built-in protection against line surges
Write for Bulletin 18A
Meriam Manometer Instrumentation
. . . for pressures, vacuums, flows, liquid levels.
meriam
INSTRUMENT COMPANY
10920 Madison Ave. • Cleveland 2, Ohio



You can now stabilize *military jet fuels* with DMD

A new military specification MIL-F-5624C approves the use of metal deactivators in military aviation jet fuels.

You can now use Du Pont Metal Deactivator to protect your military jet fuels against the harmful effects of active copper and other metallic compounds which have a detrimental effect on jet fuel stability.

The use of DMD is especially important for stockpiling and overseas operations where the storage periods and distribution lines are unusually long.

For greater flexibility

Another important advantage of using metal deactivator is the greater blending flexibility it provides. In this way, it increases the variety of blending stocks that can be used for military jet fuels. A maximum of two pounds of active ingredient of metal deactivator per 1,000 barrels of jet fuel is permitted by the new government specification.

Other uses

Du Pont Metal Deactivator was developed to prevent copper from accelerating harmful gum formation in gasolines. It also has valuable applications in kerosines, diesel and furnace fuels, and turbine oils.

Write for booklet • All of the properties, uses and methods of addition of DMD are discussed in this booklet. If you do not already have a copy, ask any of our representatives or regional offices to send you one.

DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas . Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave . . . . . Phone RAndolph 6-8630
TULSA, OKLA.—P. O. Box 730 . . . . . Phone LUther 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. . . Phone CApitol 5-1151
LOS ANGELES, CALIF.—612 So. Flower St. . . . . Phone MAdison 5-1691

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division—80 Richmond Street West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539 Wilmington 98, Delaware

By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.

Sulfur Treatment Imparts More Wear Resistance to Metal Surfaces

TO the metal engineer, there are two ways to reduce friction between two rubbing iron surfaces: (1) Lubricate the surfaces with a lubricating liquid, which often may produce a chemically reacted coating on the metal surface, or (2) treat the metal surface with chemicals to form a wear-resistant surface having a reduced coefficient of friction. In U. S. patent No. 2,707,159, Lubri-Case, Inc., describes a process to accomplish the latter which is considered of particular value in the automotive industry.

According to this patent, it has been found that articles with reduced coefficients of friction can be obtained by incorporating sulfur in a chemically combined form in superficial layers of ferrous metal pieces, to a considerable depth from the surfaces into the base metal of the pieces. The presence of substantial quantities of sulfur in ferrous metals generally is scrupulously avoided, sulfur being considered a serious contaminant of the base metal.

The ferrous metal articles here provided, however, have superficial layers substantially enriched in combined sulfur to a depth well over 0.05 mm. and up to a depth of several tenths of a millimeter, depending upon the intensity or duration of the treatment applied. The sulfurized layers so formed possess a surprisingly increased resistance to wear and a considerably reduced coefficient of friction, while the base metals bearing these layers suffer no deterioration of their desirable properties.

Articles having these important characteristics can be produced by subjecting ferrous metal pieces at elevated temperatures to the action of sulfur in the form of a sulfur compound or salt in which the sulfur is incompletely oxidized, i.e., is present in a chemically combined form other than that of sulfate sulfur. Sulfur in this form is referred to herein as active sulfur.

An effective procedure is to expose surfaces of the ferrous metal pieces at an elevated temperature to the action of such a sulfur compound in a molten state. The compound applied may be an oxygen-free sulfur salt, such as a molten alkali sulfide or sulfocyanate.

The molten, active sulfur compound is applied advantageously as part of a molten salt bath in which the metal pieces are treated by simple immersion for a suitable period, depending upon the desired depth of the treatment. The bath should also contain alkali metal or alkaline earth metal salts to serve as stabilizers, or as both carriers (diluents) and stabilizers. The active sulfur content of the bath need be only about 0.4 to 2% of its weight. The bath as a whole is composed of salts that melt at a temperature well below the elevated treatment temperature, and the constituents are selected to maintain reducing conditions in the bath, which preserve the activity of the sulfur content. For this purpose, a substantial content of an alkaline cyanide and an alkaline cyanate is particularly effective. An alkaline cyanide alone may be used as a reducing or stabilizing agent, but this becomes converted partially into alkaline cyanate when melted into the bath.

Various salts containing sulfur in an incompletely oxidized state may be used as the source of active sulfur for such molten bath compositions. Useful compounds are the alkaline sulfides, sulfites, thiosulfates, sulfocyanates and thiourea salts. Examples of the metals are sodium, potassium and lithium. Thiourea salts of these metals may be used individually or as mixtures of two or more of such compounds. When a sulfite or thiosulfate (e.g., sodium sulfite and/or sodium thiosulfate) is employed in the presence of an alkaline cyanide (e.g., sodium cyanide) the active sulfur in the molten bath is present as sulfide sulfur, by reason of the reactions:

(a) $Na_2SO_3 + 3NaCN \rightarrow 3\ NaCNO + Na_2S$

(b) $Na_2S_2O_3 + 4NaCN \rightarrow 3\ NaCNO + Na_2S + NaSCN$

The use of a sulfocyanate with an alkaline cyanide also yields sulfide sulfur in the molten bath, as well as sulfocyanate.

A considerable part, even a major proportion, of the salt bath composition may consist of compounds that serve only as carriers or diluents; for example, alkali or alkaline earth carbonates or chlorides, or other alkali metal or alkaline earth metal salts having suitable melting points and no objectionable oxidizing or metallurgical properties. Only a minor proportion of the bath composition need be composed of the reducing or stabilizing compounds and the active sulfur compound or compounds, and about 25% or more by weight of cyanide and cyanate, with these and other constituents proportioned to give the composition the desired fusion temperature.

The salt composition preferably is one that melts at a temperature below 500° C. The desired sulfurizing action then is obtained by immersing ferrous metal pieces in the molten composition at limited temperatures above 500° C., temperatures of the order of 550° C. to 600° C. being particularly effective. The period of immersion varies with the depth of the desired sulfurized layer, but should be at least 20 minutes. For example, a layer at least 0.1 mm. deep can be obtained on cast iron pieces by immersing them for about 30 minutes in a bath at about 580° C., while immersion of similar pieces in the same bath for about three hours will produce a sulfurized layer about 0.3 mm. deep.

A surprising feature of this is that such treatment greatly enhances the wear resistance of the treated surface layers but brings about little or no increase in their hardness. No appreciable carburizing or nitriding action occurs, even though cyanides and cyanates are present in the treatment bath, and it is not necessary to use treatment temperatures high enough to cause objectionable side effects or phase changes in the base metal.

One composition found to be quite effective in accomplishing the desired result is as follows:

Compound	%
NaCN	34
Na_2SO_3	7
KCl and NaCl	27
Na_2CO_3	16
K_2CO_3	16

Upon melting at 480° C., the bath had the following analysis and is designated as bath "S_1."

Compound	%
NaCNS	1.6
Na_2S	1.8
Na_2CO_3	18.9
K_2CO_3	18.9
NaCl KCl	26.8
NaCN	25
NaCNO	7.2

The active sulfur content of this bath equals 1.35%.

Wear tests performed on the Faville-Levally machine with the metal treated pieces in the dry state demonstrated the fact that a load of 2000 lbs. (the maximum permissible due to heating of the machine) could be carried

NO.2 in a series of ALUMICOAT APPLICATIONS

PROCESS
PROTECTS
REFINERY
EQUIPMENT

More and more refineries are discovering the advantages of the new ALUMICOAT Process! ALUMICOAT offers a firm resistance against corrosive media — *especially sulphur compounds* — and extreme temperatures!

In the ALUMICOAT Process, refinery parts are dipped in molten aluminum to produce a metallurgical iron-aluminum bond at the interface and a surface overlay of pure aluminum. At temperatures exceeding the melting point of aluminum, the aluminum on the surface diffuses. This diffused coating, together with the iron-aluminum bond, provides a refractory material that gives steel maximum protection against high temperature scaling.

The Alumicoat Process can solve your corrosion and oxidation problems. Send for full details today!

ARTHUR TICKLE ENGINEERING WORKS, INC.
24 Delevan Street MAin 5-4200 Brooklyn, N. Y.

without any measure of wear, whereas untreated control pieces could not withstand a load of 1250 lbs. due to rapid jamming of the jaws of the apparatus.

Patents Issued in July

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U.S. Patent Office for July 5, 12, 19, and 26, 1955, Vol. 696, Nos. 1-4.

PROCESSES

Refining

Re 24,038 (Phillips Petroleum Co.) Continuous fractional crystallization process for separating cyclohexane from isoheptane.
2,711,990 (Sumner E. Campbell) Refining of lubricating oils with aqueous aluminum sulfate, dehydration, and solvent extraction.
2,711,992 (Universal Oil Products Co.) Means for controlling pressure in a column having total condensing vapors.
2,712,519 (Edeleanu Gesellschaft m. b. H.) Process for evaporating and drying chlorinated hydrocarbons used in the dewaxing of mineral oils.
2,712,978 (Fluor Corporation, Ltd.) Amino-ether gas treating process for removing H_2S and CO_2.
2,713,022 (Esso Research & Engineering Co.) Deoiling wax cakes.
2,713,023 (Gulf Oil Corporation) Fractionating method and apparatus.
2,713,077 (Atlantic Refining Co.) Removal of carbonyl sulfide from hydrocarbon gases with anionic exchange resin.
2,713,478 (Edw. G. Ragatz Co.) Apparatus for counter-current contacting of liquids and vapors.
2,713,552 (Standard Oil Co—Indiana) Extraction of aromatics from naphthas, using HF containing silver fluoride.
2,713,559 (Petrolite Corp.) Process for breaking petroleum emulsions.
2,713,775 (Phillips Petroleum Co.) Recovery of salt free liquid from liquid having salts dissolved therein.
2,713,780 (Mississippi River Fuel Corp.) Process for separation of gases, at elevated pressure and reduced temperature.
2,713,781 (Mississippi River Fuel Corp.) Variable reversible rectification process.
2,713,894 (Texaco Development Corp.) Method and apparatus (burner) for partial combustion of gasiform hydrocarbons.
2,714,056 (Dow Chemical Co.) Method of operating mixer-settler extractors.
2,714,057 (Universal Oil Products Co.) Stabilization of burner oil against discoloration by addition of 2-amino-4-alkyl 6-alkylphenylamino-1, 4-dihydro-1, 3, 5 triazine.

Conversions

2,712,033 (Sun Oil Co.) Alkylation of aromatic hydrocarbons with HF.
2,712,495 (Standard Oil Co.—Ohio) Conversion of a fluidized carbonaceous material-water slurry to produce water gas.
2,713,044 (Olin Mathieson Chemical Corp.) Polymerization of ethylene with ozonide catalysts.
2,713,590 (M. W. Kellogg Co.) Heat treatment of solid carbon-containing materials, by passing pure oxygen through fluidized coal.
2,714,085 (Pure Oil Co.) Thermal conversion of hydrocarbons in the presence of an oxychlorine compound.
2,714,086 (Erwin Bluemner) Chemical modification of coal into hydrocarbon oils and coke.
2,714,126 (M. W. Kellogg Co.) Method of effecting conversion of gaseous hydrocarbons, using hot refractory powder.

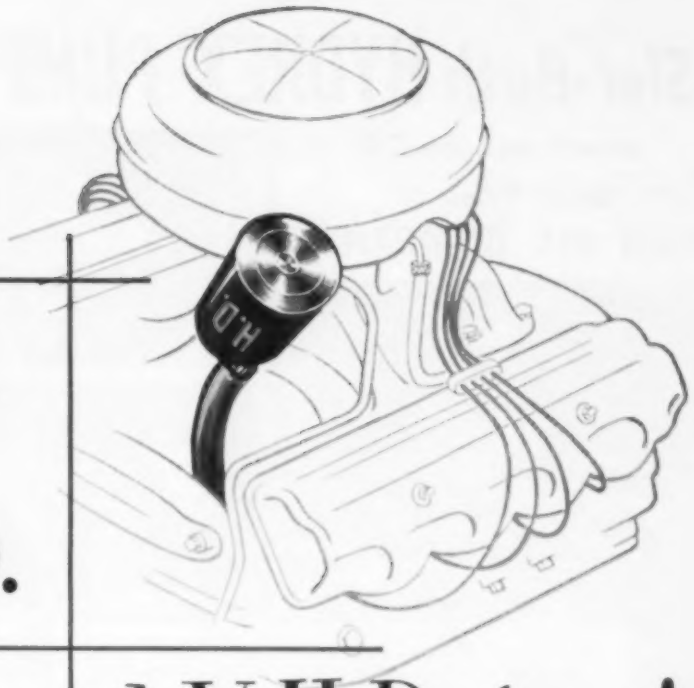
PRODUCTS

Chemicals

2,712,530 (Esso Research & Engineering Co.) Sulfonate detergent blend.
2,712,538 (Pan American Refining Corp.) Synthetic resins by catalytic polymerization of hydrocarbon pyrolysis products.
2,712,549-51 (Richfield Oil Corp.) Process of preparing toluic acids by oxidizing xylenes.
2,712,554 (Wm. T. Miller) Oxidation of halogenated olefinic compounds.

(To obtain more data on advertised products see page 1472)

Ba for H. D.



. . . and V. H. D., too!

Most H.D. lube oils contain detergent additives . . . 75% of which are barium based. Good as they are, they will have to be better to withstand *V*ery *H*eavy *D*uty in tomorrow's high-compression engines. No one realizes this more than additive researchers . . . and ourselves.

Recently, we increased capacity 100%. To provide a uniform dense crystalline oxide with screen analysis to meet users' specs, we pioneered electric furnace reduction. Presently we are piloting an advanced process developed by Westvaco engineers to provide even finer quality. To serve large additive makers, we initiated bulk shipment of barium alkalis in covered hopper cars.

When "V.H.D." lube oils are specified by engine builders the additives will be ready . . . and so will we. Largest supplier of barium chemicals since 1921, we firmly intend to maintain that position.

If you are working with lube-oil additives, we would like you to have a copy of this new, 24-page booklet giving complete information on WESTVACO Barium Chemicals.

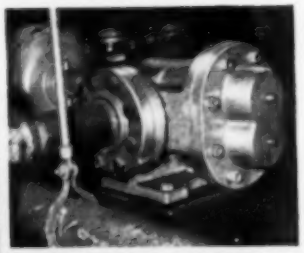
Westvaco Mineral Products Division
FOOD MACHINERY AND CHEMICAL CORPORATION
General Offices • 161 East 42nd Street, New York 17
CHICAGO, ILLINOIS • CINCINNATI, OHIO • HOUSTON, TEXAS • NEWARK, CALIFORNIA

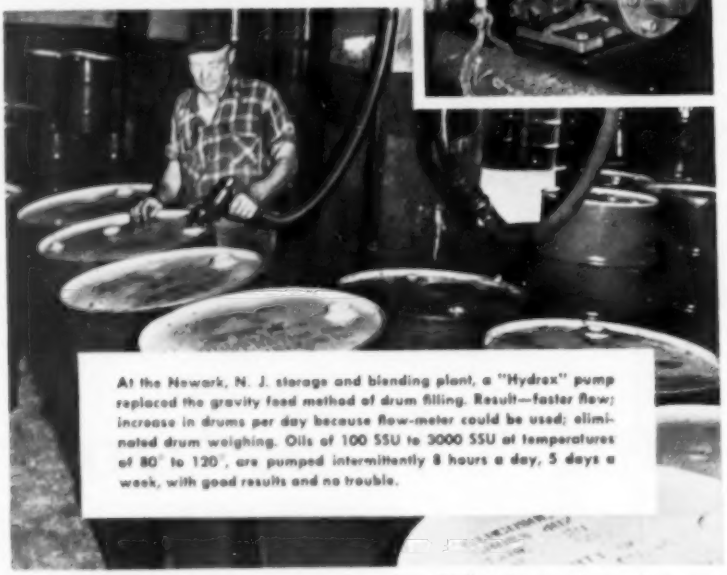
fmc Westvaco CHEMICALS

Sier-Bath HYDREX® PUMP

speeds up Lube Oil Drum Filling at

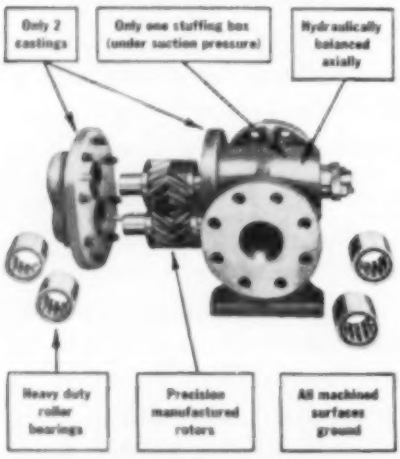
SUN OIL COMPANY





At the Newark, N. J. storage and blending plant, a "Hydrex" pump replaced the gravity feed method of drum filling. Result—faster flow; increase in drums per day because flow-meter could be used; eliminated drum weighing. Oils of 100 SSU to 3000 SSU at temperatures of 80° to 120°, are pumped intermittently 8 hours a day, 5 days a week, with good results and no trouble.

Sier-Bath HYDREX PUMP


Only 2 castings
Only one stuffing box (under suction pressure)
Hydraulically balanced axially
Heavy duty roller bearings
Precision manufactured rotors
All machined surfaces ground

The simplest heavy duty gear pump made! Use it in place of pumps costing much more . . . for handling chemical solutions, fuel oils, lube oils, hydraulic liquids, etc.

The "Hydrex" needs no costly speed reducer—can be direct-connected up to 1800 RPM. Extreme simplicity allows heavier construction, easier installation and maintenance, less downtime, longer life.

Models available to pump liquids from 32 SSU to 250,000 SSU, at 1 to 350 GPM, up to 500 PSI. Call your local Sier-Bath Pump Representative . . . write to *Sier-Bath Gear & Pump Co., Inc., 9261 Hudson Blvd., North Bergen, N. J.*

Sier-Bath ROTARY PUMPS

Screw Pumps Gearex® Pumps Hydrex® Pumps

50th Anniversary Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings Member A.G.M.A.

Patents

2,712,555 (Wm. T. Miller) Oxidation of halogenated saturated hydrocarbons.

2,712,559 (Phillips Petroleum Co.) Treatment of hydrocarbon gases containing acetylene with steam in presence of zinc zirconate to produce acetaldehyde.

2,712,561 (Esso Research & Engineering Co.) Drying oils by copolymerizing butadiene with styrene in presence of sodium. (C-4,017)

2,712,562 (Esso Research & Engineering Co.) Continuous method for producing liquid polybutadiene with alkali metal catalyst.

2,712,982-5 (Dow Chemical Co.) Carbon bisulfide production by reacting sulfur with paraffinic hydrocarbon in presence of catalyst.

2,713,067 (DuPont Co.) Adipic acid recovery process (oxidation of cycloparaffin).

2,713,071 (Allied Chemical & Dye Corp.) Telomerization of ethylene and saturated monohydric alcohols.

2,713,072 (Shell Development Co.) Production of bis (hydroxyaryl) substituted compounds.

2,713,073 (Esso Research & Engineering Co.) Catalytic hydrogenation of oxo aldehydes.

2,713,075 (Esso Research & Engineering Co.) Metal oxide treatment of oxo alcohols.

2,713,567 (Shell Development Co.) Composition containing glycidyl poly-ether and a polyvinyl acetal resin.

2,713,586 (Ethyl Corp.) Process for the oxidation of ethylene to ethylene oxide.

2,713,600 (California Research Corp.) Preparation of isopropyl benzene hydrocarbons.

2,713,601 (Union Oil Co. of California) Production of acetylene using oxygen-containing gas on hydrocarbon.

2,714,087 (Gulf Research & Development Co.) Stabilization of phenol alkylates with alkali.

2,714,121 (Shell Development Co.) Process for production of halohydrins.

2,714,122 (Shell Development Co.) Production of dichlorohydrins.

Fuels

2,711,842 (Northrop Aircraft, Inc.) Vapor purging system in fuel containers.

2,711,947 (Gulf Oil Corporation) Stabilized hydrocarbon fuel oils containing a condensation product of ammonium sulfide, formaldehyde, and a monoalkyl phenol.

2,712,497 (Phillips Petroleum Co.) Jet engine fuel comprising hydrocarbons and aromatic gum inhibitor.

2,712,726 (Phillips Petroleum Co.) Method of operating a jet engine by using hydrocarbon fuel containing polymer V.I. improver.

2,714,060 (Virgil Stark) Process of treating oilgas to produce utility gas of low heat content and low gravity with valuable by-products, using combustion hot blast.

Lubricants

2,712,363 (Tide Water Associated Oil Co.) Minimizing loss of transparency of sight feed lubricating fluids containing detergent soaps by feeding oil through aqueous metal halide.

2,712,518 (Tide Water Associated Oil Co.) Pour-point reduction with glyceryl 12-hydroxy stearate.

2,712,526 (Esso Research & Engineering Co.) Hydrocarbon oil additive (thialdine reacted with sulfur-containing acid).

2,712,527 (Esso Research & Engineering Co.) Improved lubricating greases containing dihydroxy stearic acid soap.

2,712,528 (Esso Research & Engineering Co.) Mineral oil composition containing an improved hydrocarbon-phosphorous sulfide reaction product.

2,713,034-5 (Atlantic Refining Co.) Treatment of barium petroleum sulfonates.

2,713,557 (California Research Corp.) Basic phenates to inhibit alkyl corrosion in thiophosphate containing lubricating oils.

2,713,558 (Shell Development Co.) Lubricating compositions containing selenium dihydrocarbyl dithiocarbamate.

2,714,091 (National Research Council) Preparation of lubricating grease, using finely divided, low bulk density absorbent.

2,714,092 (The Texas Co.) Lithium base grease containing group II divalent metal alkyl salicylate, such as zinc alkyl salicylate, as copper corrosion inhibitor.

Specialties

2,712,535 (Allied Chemical & Dye Corp.) Ethylene-isopropanol telomer additive for upgrading paraffin waxes.

2,714,055 (Phillips Petroleum Co.) Process of producing increased yields of tar-free carbon black.

Miscellaneous

2,713,037 (Esso Research & Engineering Co.) Method of making alumina-containing catalysts.

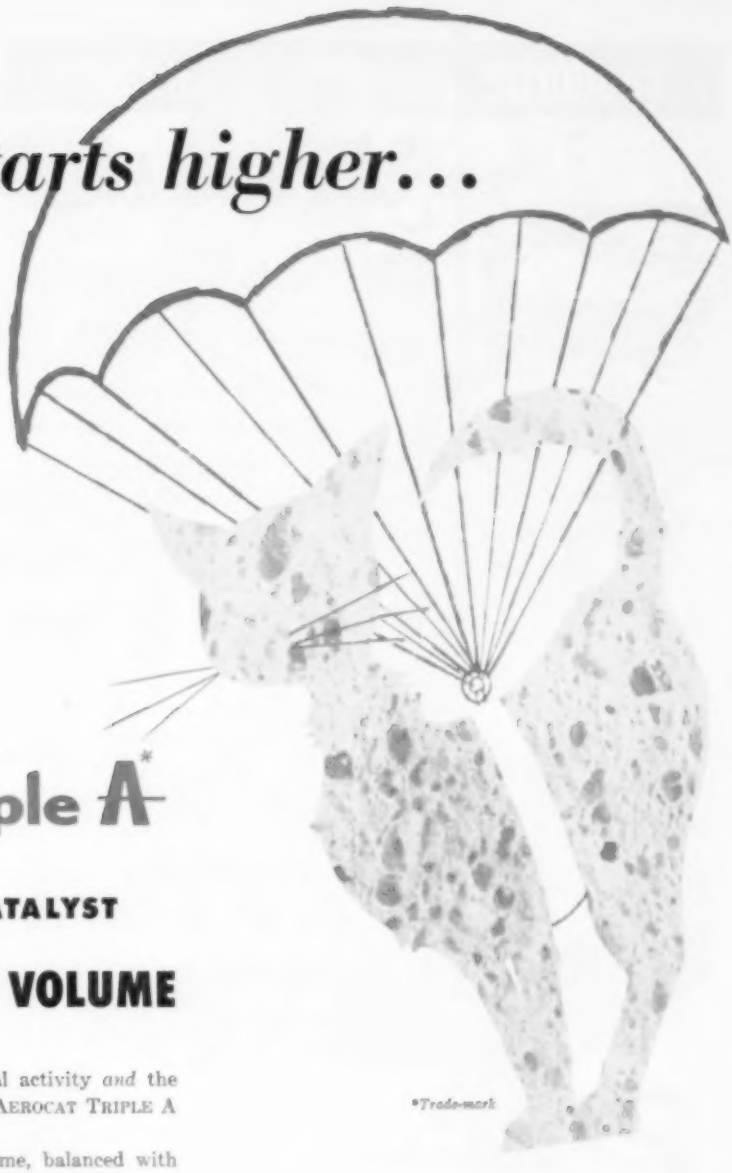
2,713,560 (Jacques C. Morrell) Phosphoric acid catalyst and methods of making same.

2,714,114 (Phillips Petroleum Co.) Continuous process and apparatus for refining glyceride oils.

2,714,116 (Texaco Development Corp.) Hydrocarbon synthesis with catalyst of less than one micron.

(To obtain more data on advertised products see page 1472)

Activity starts higher... comes down slower



Aerocat Triple A*

HIGH ALUMINA CATALYST

WITH HIGH PORE VOLUME

Now Cyanamid offers both high initial activity *and* the highest available activity stability—in AEROCAT TRIPLE A High Alumina Catalyst.

The reason is new higher pore volume, balanced with optimum values of pore diameter and specific surface to give the refiner increased thermal and steam stability. At the same time, these carefully controlled pore characteristics retain the other advantages of AEROCAT TRIPLE A:

- **lower stack losses**
- **improved fluidization**
- **excellent selectivity**

Developed through 7 years of research, AEROCAT TRIPLE A High Alumina Catalyst is in use in 27 operating units. This extensive commercial experience has enabled Cyanamid to make precise determinations of cracking efficiency and product distribution with AEROCAT TRIPLE A in equilibrium.

Ask your Cynamid representative about AEROCAT TRIPLE A High Alumina Catalyst with **Hi PV***. He'll tell you how it can increase your volume of output per ton of catalyst used—or improve performance at the same usage rate.

*Trade-mark

AMERICAN Cyanamid COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

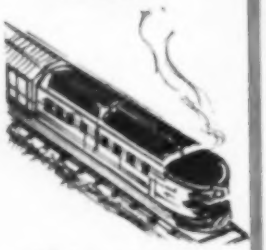
reodorize petroleum malodors with Alamask!

Make olfactorily acceptable petroleum products!

Producers of petroleum products and of petro-chemicals – by adding a selected ALAMASK reodorant – can improve odor characteristics of such materials. A specific ALAMASK is available to achieve adequate reodorization of a variety of petroleum products.

FOR REODORIZATION OF:

FUEL OILS *(regular or premium gasoline blends)*
KEROSENE
DIESEL OILS
CUTTING OILS and SPECIALTIES
many other petroleum products



Gain olfactory relief with an ALAMASK.

Write, wire or phone for specific information. Our Engineering Section provides complete technical guidance.

Rhodia INC.
230 Park Avenue, New York 17, N. Y.
PLANT: PATERSON, N. J.

You'll want a REPRINT for your own files of

"It's Time to Take a New Look at CATALYTIC REFORMING"

the Special 48-page Report in the August issue

Single copies—$0.75, postpaid

Send orders to: Reader's Service Dept.
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N. Y.

New York City residents, add 3% city sales tax

Patents

Processing, general

2,712,361 (Food Machinery and Chemical Corp.) apparatus for separating materials by continuous liquid thermal diffusion.
2,712,386 (Standard Oil Co.—Ohio) Method and apparatus materials by continuous liquid thermal diffusion.
2,712,396 (Benona C. Mowat) Proportional mixing container.
2,712,438 (Brown Fintube Co.) Heat exchanger.
2,712,476 (John Happel) Method of conveying granular solids.
2,712,520 (Du Pont Co.) Spinning-band fractionating column.
2,712,961 (Research Corp.) Spray device.
2,712,981 (Surface Combustion Corp.) Gas generator and process for producing dry gas.
2,713,023 (Gulf Oil Corp.) Fractionating apparatus.
2,713,026 (Process Engineers, Inc.) Flotator-clarifier.
2,713,476 (Adolphe F. Steichen) Apparatus for treating gases by means of a liquid.
2,713,478 (Edward G. Ragatz Co.) Apparatus for counter-current contacting of liquids and vapors.
2,713,895 (Blaw-Knox Co.) Apparatus for supplying and distributing liquids.
2,713,994 (Henry W. Angelery) Heat exchanger.
2,713,996 (John E. Pottharst, Jr.) Heat exchanger.
2,714,058 (Gas Machinery Co.) Apparatus for making oil gas by pyrolitic treatment.
2,714,059 (Phillips Petroleum Co.) Means for making fuel gas.

Instruments

2,712,239 (Ralph J. Havens) Pressure determination device.
2,712,321 (Minneapolis-Honeywell Regulator Co.) Control apparatus.
2,712,752 (Stamicarbon N.V.) Apparatus responsive to variations in the viscosity of a liquid.
2,712,795 (Aktiebolaget Svenska Kullagerfabriken) Pneumatic-hydraulic pressure device.
2,712,885 (Standard Oil Co-Ohio) Selective fluid metering system.
2,713,124 (Instruments, Inc.) Radioactive radiation apparatus for measurement of level of material in tanks.
2,713,261 (Sperry-Sun Well Surveying Co.) Self-contained flowmeter.
2,713,265 (Weston Electrical Instrument Corp.) Dual element thermometer.
2,713,267 (Wallace & Tiernan) Pressure totalizing apparatus.
2,713,272 (Albert J. Granberg) Temperature compensating coupling for liquid meters.
2,713,790 (The Texas Co.) Rotational viscometer.
2,713,793 (Chemstrand Corp.) Bin-level indicator.
2,713,794 (Clyde A. Burns) Well liquid gage.
2,714,167 (The Texas Co.) Liquid level measuring apparatus.
2,714,168 (The Texas Co.) Radioactivity flowmeter.

Pumps & Compressors

2,712,286 (Arthur F. Kiefer) Diaphragm pump.
2,712,792 (Scott-Atwater Mfg. Co.) Pump structure.
2,712,793 (H. Maihak) Pumps.
2,712,794 (Marion W. Humphreys) Fluid motor or pump.
2,713,311 (Howard T. White) Motor driven pump.
2,713,312 (Denison Engineering Co.) Pressure compensator.
2,713,826 (Fairbanks, Morse & Co.) Fluid pumping system.

Valves & Fittings

2,712,324 (Dole Valve Co.) Fluid mixing valve.
2,712,429 (William Alton Ray) Fluid control valve.
2,712,455 (National Supply Co.) Pressure actuated seal with relief means.
2,712,458 (Leonard Lipson) Pipe couplings.
2,712,828 (Parker Appliance Co.) Valve mechanism for filling and controlling tank fluid level.
2,712,949 (American Brass Co.) High-temperature metal hose connection.
2,713,268 (Robert M. Langsenkamp) Liquid sampler.
2,713,269 (Maryland Engineering Co.) Fluid sampling and testing equipment.
2,713,344 (Perfection Mfg. Corp.) Flushing system for vacuum fluid lines and valve therefor.
2,713,352 (Edward H. Schustack) Pipe coupling.
2,713,504 (Edgar Padbury Coleman) Fluid tight joints.
2,713,556 (Cochrane Corp.) Liquid flow control apparatus.
2,713,987 (Duriron Co.) Valve for corrosive fluids.
2,713,989 (Grove Valve Regulator Co.) Valve construction.

Miscellaneous

2,712,395 (John H. Wiggins) Overflow device for liquid storage tanks.
2,712,426 (Sun Oil Co.) Reactor supports.
2,712,730 (J. F. Pritchard & Co.) Apparatus for storing gases.
2,714,080 (Pyrate Sales Inc.) Tank cleaning device.

(To obtain more data on advertised products see page 1472)

ENGINEERING

RESEARCH & DEVELOPMENT

QUALITY CONTROL

EXPERIENCE

There are Qualities *Behind* ANNIN VALVES you'll never find in imitations

ANNIN DEVELOPED AND INTRODUCED:

SPLIT BODY

The Annin split-body design has given Industry new standards in control valve construction: lower body pressure loss, greatly reduced erosion, greater rangeability, longer life and reduced maintenance.

DOMOTOR OPERATOR

Out-performs all other pneumatic valve actuators. They are the highest speed, most powerful, and provide the best response characteristics. Long strokes assure that all size valves are truly hi-lift control valves.

TEFLON SEAT SEAL

The teflon seat seal for absolute tight closure, teflon guide bushing to eliminate guide clearance, and teflon V-ring packing for reliable stuffing-box performance were developed and introduced by Annin.

DOOLSEAL

Providing a new high in stuffing-box practice, the Doolseal, originally developed and introduced by Annin, assures reliable seal for hard-to-handle or toxic chemicals without resorting to mechanical seals.

...and many others!

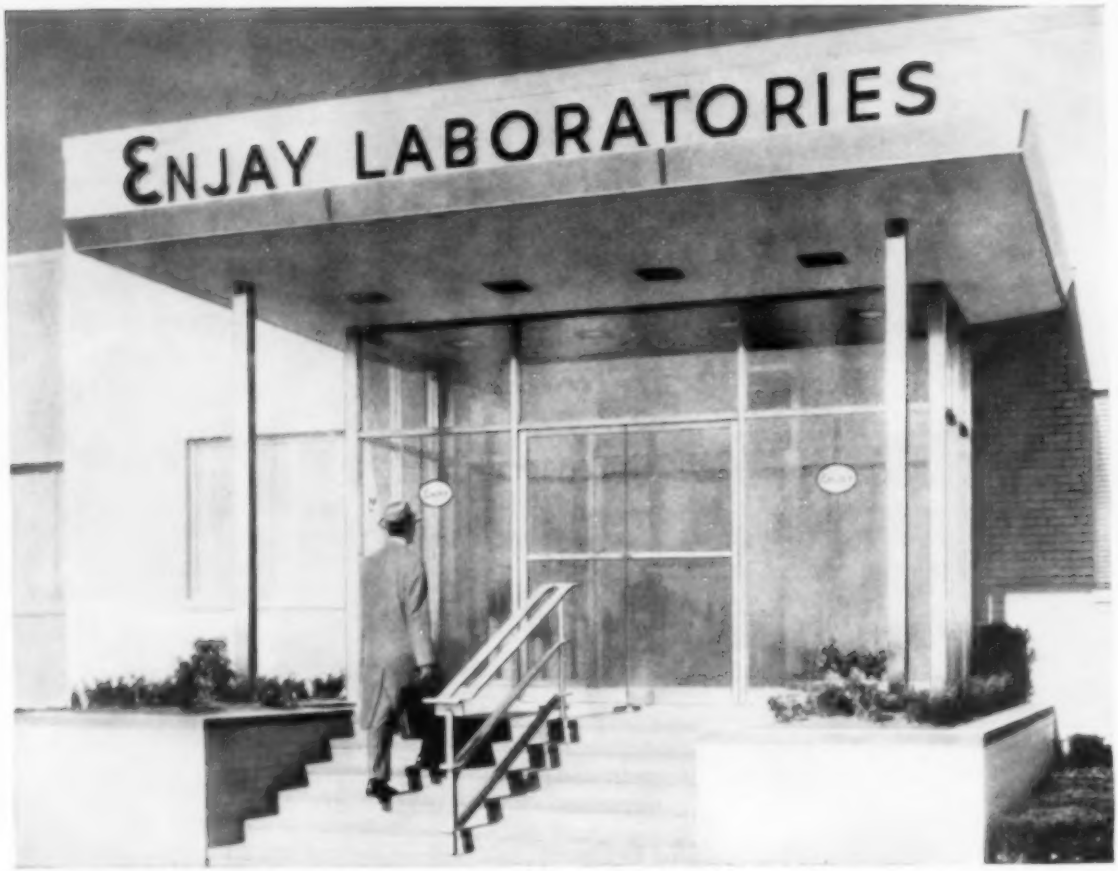
CUT INVENTORY 50% WITH

ANNIN

Control VALVES

THE ANNIN COMPANY

6570 East Telegraph Road
Los Angeles 22, California



Look to Enjay

for dynamic leadership in petroleum chemicals

Phenomenal is the word for the rise of America's petrochemical industry. Dynamic is the word for the Enjay Company's record of leadership in this industry. Again and again Enjay, pioneer and leading supplier of petroleum chemicals to industry, has led the way in research, development and production. Here are some highlights from Enjay's outstanding record of pioneering and progress.

1920 —*Isopropyl alcohol manufactured by Enjay affiliate.*
1931 —*Enjay's Paraflow pour depressant developed.*
1935 —*Enjay's V. I. improver offered to oil industry.*
1936 —*Lube oil inhibitors introduced.*
1937 —*Enjay's Butyl rubber discovered.*
1941 —*Buna Plant, which first made commercial Buna-S in U. S. in 1942, started up by Enjay affiliate. First private Butyl plant begun by Enjay affiliate.*
1943 —*Butyl rubber produced in Government-owned plants operated by Enjay affiliates.*
Mid-1940's —*Broad line of petrochemicals introduced by Enjay.*
1948 —*First commercial Oxo plant in U. S. operated by Enjay affiliate.*
1955 —*Enjay markets Butyl rubber produced in plants acquired from the government.*

Today, with the added resources of the new million dollar Enjay Laboratories, Enjay is better equipped than ever before to serve its customers. Available is expert technical assistance and service in the use of Enjay Butyl and other polymers, chemical raw materials, Paramins for improving petroleum products, alcohols and oxygenated solvents. You are invited to contact the Enjay Company for information, supplies of these products or services of the Enjay Laboratories.

ENJAY

35 successful years of leadership in serving industry

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y. Other Offices: Akron•Boston•Chicago•Tulsa

Worthington Adds New Facilities

More space for the manufacture of standard pumps and other company products has been purchased by Worthington Corp. The 15-acre site was owned by Crocker-Wheeler Electric Manufacturing Co. and is located in the Ampere Section of East Orange and Newark, N. J. Already on it are 12 buildings, which provide over 330,000 sq. ft. of working floor space.

The engineering, sales and service staffs of the standard pump division, as well as the general manager's headquarters, will be among the company units relocated at the new plant in the near future.

Macy Elected TEMA President

Officers for 1955-56 were elected recently by the Tubular Exchanger Manufacturers Association. President is T. E. Macy, M. W. Kellogg Co.; vice-president is E. E. Dillman, Engineers & Fabricators, Inc.; and secretary-treasurer is George P. Byrne, Jr., New York City.

A new executive committee was also elected and is composed of Mr. Macy; Mr. Dillman; T. H. Miley, Foster Wheeler Corp.; and G. B. Faust, Southwestern Engineering Co.

Southwest Gives Post to Dressler

Dr. Russell G. Dressler has joined Southwest Research Institute as manager of chemical engineering research. Dr. Dressler's work as a chemical engineer has shown unusual versatility. He is widely known for developing the formula for the separation of paraxylene, a basic stage in Dacron manufacture. He was instrumental in ironing out kinks in the government's napalm-gel incendiary bomb during the second World War. Furthermore, Dr. Dressler planned the layout, directed the construction and supervised the operations of the first large scale gasoline-from-coal plant, which was run by the U. S. Bureau of Mines in Louisiana.

Dr. Dressler

He has had wide experience in the fields of petrochemicals, high-pressure hydrogenation of organics, oils and fats technology, chemical process development and others.

He received his B.S., M.S. and Ph.D. degrees from the University of Southern California and has published some 20 technical articles.

A HEAD FOR HOLLAND is taken to the boat from the factory of Lukens Steel Co. for delivery to one of the subsidiary companies of Royal Dutch Petroleum Co. in The Hague. Weighing nearly 13 tons and with a diameter of 19 feet, the stainless-clad steel tank closure is one of the largest ever formed. This one made the trip in one piece, though usually they are cut apart for shipping and welded together once they reach their destination overseas.

UOP Absorbs Polychem Co.

Universal Polychem Co., a wholly owned subsidiary of Universal Oil Products Co., has been merged into the parent company where it will carry on the manufacture of various types of catalysts, inhibitors and other forms of additives as a separate division of UOP and without change in policies or personnel.

M. R. Schrein, formerly vice-president and general manager of the subsidiary, has been appointed vice-president of Universal with responsibility for manufacturing.

ASTM Elects New Officers

New officers of the American Society for Testing Materials, elected at the society's recent convention, are as follows:

President (1955-56), Claire H. Fellows, director, engineering laboratory and research department, Detroit Edison Co.

Vice-president (1955-57), Richard T. Kropf, vice-president and director of research, Industrial Thread Division of the Belding Heminway Co.

Directors (1955-58): F. L. LaQue, vice-president and manager of development and research division, International Nickel Co.; A. Allan Bates, vice-president for research and development, Portland Cement Association; Richard C. Alden, chairman, research planning board, Phillips Petroleum Co.; John C. Moore, director, technical section, National Paint, Varnish and Lacquer Association; and E. F. Lundeen, assistant superintendent, quality control department, Inland Steel Co.

Kerbey New Midwest President

Eric A. Kerbey, executive vice-president of Midwest Piping Co., St. Louis, Mo., has been elected president of the company. He succeeds A. H. Stoughton, who continues as chairman of the board and chairman of the executive committee.

Kerbey joined the company in 1928 to establish the Chicago sales office and was named eastern manager a year later. In 1942 he transferred to St. Louis and was later named executive vice-president.

Personnel Changes

Crane Co.—R. H. Hunter, manager of the Tulsa branch since 1946, to district manager with headquarters at Dallas, succeeding J. A. McMurry, who has been named director of the company's branches, with headquarters in Chicago.

Poole-Pritchard, Ltd. — L. Earle Colburn to technical sales manager for this firm of engineers and constructors in Calgary, Alberta.

Cooper-Bessemer Co. — C. M. Reagle to district manager of the New

don't be HALF INFORMED

SEE

the amazing Airetool tube expansion control system ...IN ACTION!

Get a demonstration of this *precision* method of rolling perfectly bonded tube joints! The AIRETOOL Tube Expansion Control System rolls expanded joints in *half the time* normally required . . . it makes joints tight and leak-proof every time with no rerolling . . . it eliminates over-expansion and distortion of tubes. Simply set the control and go to work —it's entirely automatic.

Ideal for maintenance and production use, the AIRETOOL Tube Expansion Control System speeds fabrication of condenser and heat exchanger bundles . . . it cuts costs . . . boosts output. Contact your nearest AIRETOOL representative for a convincing demonstration.

WRITE for full details and information on AIRETOOL tube maintenance equipment suited to your particular needs.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

Representatives in principal cities of U.S.A., Canada, Mexico, South America, England and Japan

BRANCH OFFICES: New York, Chicago, Philadelphia, Tulsa, Houston, Baton Rouge

York domestic territory, in addition to his other posts, i.e., manager of marine sales, vice-president, and director.

Panellit, Inc. — Neil M. Blair to manager of the newly created instrument services division, which will offer overall instrumentation studies and surveys, installation and other services outside the normal range of company activities.

Western Supply Co.—H. W. Severance to sales representative for heat exchanger sales in Louisville and Ohio Valley areas. Severance operates his own company at 702 Marion E., Taylor Building, Louisville, Ky.

Allied Chemical & Dye Corp.—I. H. Munro to vice-president of the Solvay Process Division.

U. S. Steel Corp.—Charles W. Lee to president of Consolidated Western Steel Division; T. D. Brissman to special representative to the oil and gas industry for National Tube Division.

Cooper-Bessemer Corp.—James W. Reed, vice-president, to Pacific Coast manager in charge of the offices at Los Angeles, San Francisco and Seattle.

Condenser Service & Engrg. Co.—Nicholas Weber to vice-president in charge of engineering activities; George W. Nigh, formerly of Tide Water Associated Oil Co., to works manager.

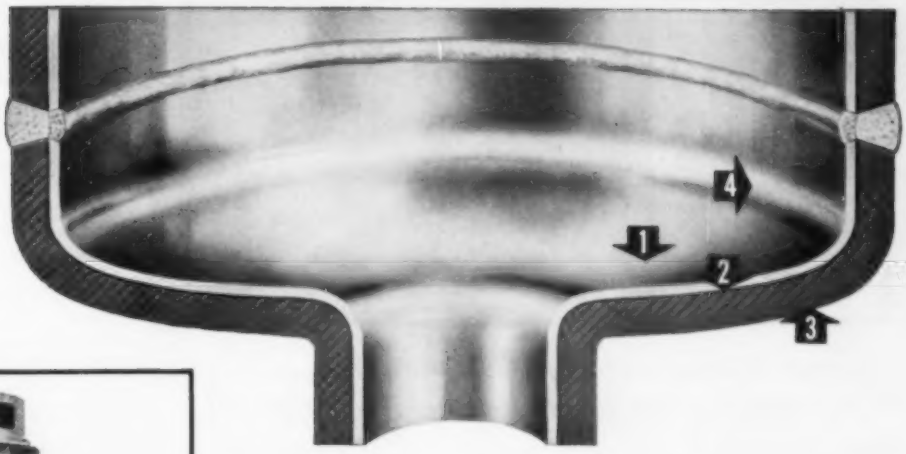
Calumet & Hecla—Gerald S. Feild to sales representative in Georgia, with headquarters in Atlanta at 2366-A Lindmont Circle, N. E.; R. C. Cain to the new sales offices in San Francisco as sales representative. Both men are with Wolverine Tube Division.

Girdler Co.—Dr. Richard L. Harvin to process engineer in the Gas Process Division.

Carlisle Chemical Works, Inc.—Vern E. Johanson to sales representative in the southwestern territory.

Du Pont Co.—W. Samuel Carpenter III to assistant director of sales of the Petroleum Chemicals Division, succeeding M. H. Campbell, who has been transferred to the new isocyanates sales section in the Elastomers Division.

Diamond Alkali Co. — James A. Hughes, vice-president and general



This nickel-clad steel agitator kettle handles chlorinated hydrocarbons under severe operating conditions.

1. **ECONOMY**—High-alloy layer—usually 10% or 20% of total plate thickness—assures corrosion and abrasion resistance, long equipment life.
2. **DESIGN FREEDOM**—Integral bond allows design and fabrication of shapes to meet process and space needs.
3. **STRUCTURAL STABILITY**—Carbon or alloy steel backing gives required strength and rigidity at lower cost.
4. **LESS MAINTENANCE**—Smooth, hard surfaces, rounded corners and sloping bottoms mean easy cleaning and draining.

CLAD STEEL EQUIPMENT IS **EASIER** TO CLEAN AND MAINTAIN

In those parts of your process where unscheduled shutdowns mean a big operating loss, clad steel equipment's smoother, more uniform surfaces mean easier cleaning and drainage to help reduce over-all corrosion rates. Preventive maintenance is simplified, for clad tanks and vessels are easier to inspect than lined equipment. The layer of high-alloy cladding gives all the protection and corrosion resistance of solid alloy material, does not permit seepage or crevice corrosion.

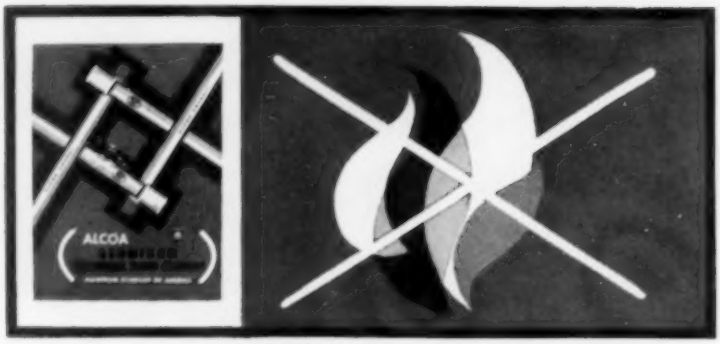
Sixteen types of Lukens' clad steel—stainless, nickel, Inconel, Monel, copper — give you these advantages at *savings up to 50%* in material costs over solid high alloys. The API-ASME Code permits full gage consideration for design purposes because cladding and backing are bonded over their entire surface.

Clad steel equipment assures long life with minimum maintenance, economy of field erection, resistance to thermal shock and easy modification as processes change. Take advantage of these benefits, check with *qualified* equipment builders. Working with your engineers and consultants, they can help you get more for your equipment dollar. We offer the widest selection of clad steels available anywhere and we can help in the selection of the type of clad steel that best suits your needs. If you would like more information, consult one of your equipment builders or write Manager, Marketing Service, 752 Lukens Building, Lukens Steel Co., Coatesville, Penna.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE



Protect Against Sparks and Rust With Nonsparking, Corrosion-Resistant Alcoa® Aluminum Rigid Conduit!

Rigid conduit of Alcoa Aluminum protects petroleum processing plants against two costly things—sparks and rust. And costs less than any other corrosion-resistant, nonsparking, metallic conduit!

You'll find all the facts on this lowest cost, nonsparking, corrosion-resistant, rigid conduit in this book published by Alcoa. Facts on applications, advantages, installation and sizes. Send for your free copy, today.

Just fill out the coupon and mail to: ALUMINUM COMPANY OF AMERICA, 2324-J Alcoa Building, Mellon Square, Pittsburgh 19, Pennsylvania.

Your Guide to Aluminum Value

ALCOA RIGID CONDUIT MADE OF ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Gentlemen:

Please send me your book on the lowest cost, corrosion-resistant, nonsparking, rigid conduit: *Alcoa Aluminum Electrical Rigid Conduit.*

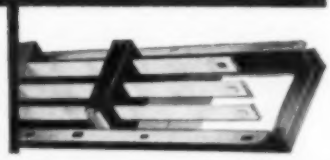
Name _____ Title _____

Company _____

Address _____

City _____ State _____

New Alcoa Aluminum Bus Conductor makes bus systems stronger, lighter; cuts costs! Bus systems using Alcoa's new No. 2 EC bus bar provide the best combination of strength, light weight and conductivity at a saving of up to 10%. Specify Alcoa Aluminum Bus Conductor.



Do You Have A Copy Of . . .

"REFINERY INSTRUMENTS—WHAT MAKES THEM TICK?"

A series of 8 articles by Cornelius E. Shannahan, instrument engineer with M. W. Kellogg Co., dealing with the four basic refinery instruments (pressure, temperature, flow, level), plus sections on controllers, control valves and pneumatic transmission.

40 pages, 9¼x11¼, paper bound (1951-2) $1.00

Address Reader's Service Department
PETROLEUM PROCESSING
330 West 42nd St, New York 36, N. Y.

Note: New York City residents add 3% Sales Tax.

Suppliers

manager of the Bryant Heater Division of Affiliated Gas Equipment, to treasurer of Diamond Alkali.

Wyatt Metal & Boiler Works—Raleigh Hortenstine, president, to chairman of the board; Walter B. Van Wart, executive vice-president, to president; Inge Grant, vice-president, to manager of operations.

Fluor Corp.—J. P. Wiseman, formerly president of Fluor Corp. of Canada, Ltd., to head of a newly established products company set up within the parent firm's group of consolidated companies to handle manufacturing, sales and erection of company products. J. C. Bounds is succeeding Wiseman at the Canadian affiliate.

Weston, Eckenfelder and Associates—Roy F. Weston has resigned his post of sanitary engineer with Atlantic Refining Co. to give his full attention to the consulting firm, which used to be known as Weston, Eckenfelder and Hood. Mr. Weston maintains offices in Newtown Square, Pa., and Mr. Eckenfelder is at Leonia, N. J.

Industrial Models, Inc.—J. J. Zimmerman to the position of New York manager; R. L. Engler to Cleveland manager.

Branches, Distributors

Perkin-Elmer Corp. has formed a new regional sales office to serve the western and northwestern states, located in the Citizens National Bank Building, North Marengo St., Pasadena, Calif.

Calumet & Hecla, Wolverine Tube Division, has opened new general sales offices in the Guardian Building, Detroit, 26, Mich. Phone is Woodward 1-7250. The division's north California offices have been moved from San Mateo into San Francisco at 1301 Sixth St.

Fischer & Porter Co. has opened a district sales office at 607 Montana St., El Paso, Texas. Charles Allen, formerly a field engineer in the Houston office, has been appointed district manager.

Expansion, Transition

Imperial Chemical Industries (New York), Ltd., has moved its executive offices to 488 Madison Ave., New York City.

Brown Fintube

The above photo shows a large Houston Petro-Chemical (Synthetic Ammonia) Plant with 9 compressor stations . . . a total of 54 coolers or 306 high pressure heat exchanger sections. Pressures from 72 psi to 5300 psi.

Brown high pressure heat exchanger sections are now performing, with high efficiency, in almost all the Petro-Chemical plants that have been built in the last five years.

BFT high pressure sectional heat exchangers are available for pressures up to 22,000 psi.

High Pressure

HEAT EXCHANGER SECTIONS

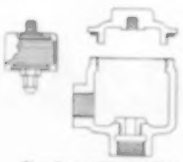
HEAT EXCHANGE EFFICIENCY
BROWN FINTUBE
HEAT TRANSFER PRODUCTS

BROWN FINTUBE COMPANY

Elyria, Ohio

STEAM TRAP

Simplicity



Simple, positive action. Has only three parts —thermostatic bellows, body, cap. Won't leak!

Nicholson simplicity. Pays off big in petroleum processing—in peak performance, easy maintenance. Simple in design, simple in operation, Nicholson Industrial Traps prove the most effective method for discharging condensate and air from steam lines.

- **Fast, intermittent valve action.**
- **Tight, positive shut-off.**
- **No dribbling. No waste of steam.**
- **Low operating cost. Low maintenance.**

Before you specify, check Nicholson. Write for *Catalog 953*.

NICHOLSON

W. H. NICHOLSON and Company

TRAPS • VALVES • FLOATS • METAL PARTITIONS

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 50 PRINCIPAL CITIES

A COMPLETE LINE OF LIQUID SEPARATORS AND FINE FILTERS FOR LIGHT PETROLEUM PRODUCTS

EXCEL-SO D-Model Filter

HP-700 High Volume Separator Filters

FRAM Liquid Separator Filters

EXCEL-SO Calibrating Tanks

The extensive research facilities and wide experience of FRAM and WARNER LEWIS COMPANY are now combined to provide scientific liquid separation and filtration for Refinery process streams, pipelines, and petroleum marketing installations.

Inquiries are invited on your particular problems.

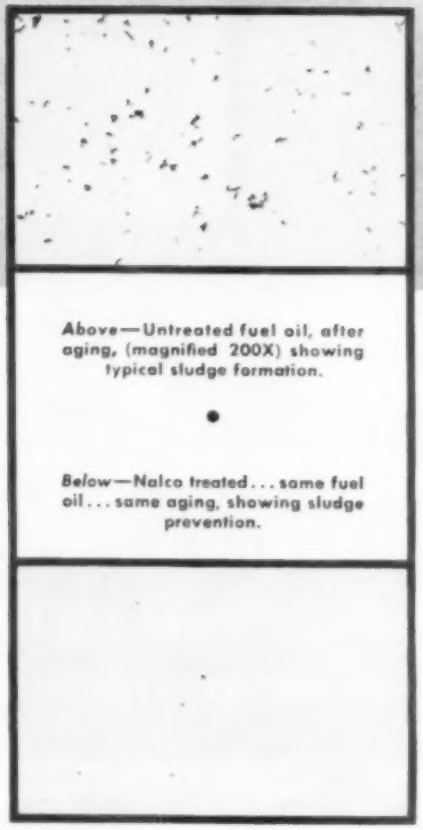
DIVISION OF FRAM CORPORATION

WARNER LEWIS COMPANY

BOX 3096 • TULSA, OKLAHOMA

STABILIZE
DISTILLATE FUEL OILS

with *Nalco* Fuel Oil Treatments



Above—Untreated fuel oil, after aging, (magnified 200X) showing typical sludge formation.

Below—Nalco treated... same fuel oil... same aging, showing sludge prevention.

- STOP COLOR DEGRADATION
- PREVENT SLUDGE FORMATION
- INHIBIT RUST AND CORROSION

and

- FLUIDIZE OLD SLUDGE DEPOSITS

Action of Nalco Fuel Oil Treatment on your distillate fuel adds up to better marketability, easier handling, and lower storage tank and oil line maintenance costs. Nalco stabilization protects the original color of distillate oils, controls sludging tendencies . . . assures salability despite storage and handling delays that frequently deteriorate untreated oils. And once sold, Nalco treated oils perform better . . cut down customer complaints of filter or screen clogging and burner fouling.

Nalco treatments give you all these benefits at low chemical dosage . . . and at low chemical cost.

CLEAN TANK BOTTOMS

Sludge deposits in tanks of residual fuel and crude oil can be cleaned up quickly and conveniently with powerful dispersion type treatments offered by Nalco. Labor costs are eliminated, maximum storage capacity is restored, and *sludge is converted to usable oil.*

Write or phone today, for full data on Nalco stabilizers and dispersants . . . the effective, low-cost way to protect your equipment, *and to safeguard product quality.*

NATIONAL ALUMINATE CORPORATION
6258 West 66th Place • Chicago 38, Illinois
Telephone: POrtsmouth 7-7240
In Canada: Alchem Limited, Burlington, Ontario

A *Nalco*® **PRODUCT... Serving the Petroleum Industry through Practical Applied Science**

Refinery Tours at AIEE Conference

REFINING, transportation and production will share the limelight at the Electrical Conference of the Petroleum Industry, to be given at the Shamrock Hotel, Houston, September 12 to 14, by the American Institute of Electrical Engineers.

Tours will be conducted during the meeting. Among them will be visits to the refineries of Sinclair Refining Co. in Houston, and Humble Oil & Refining Co. at Baytown.

Papers of special interest to refiners to be read during the conference are as follows.

Monday, September 12

"Current Practices in Classifying Areas for Electrical Installations," by Dr. L. M. Goldsmith, Atlantic Refining Co.

"Power Systems for New Refinery With Major Electrical Drives," by N. A. Austin, Standard Oil Co. of Calif.

"Modern Protective Relaying for Refinery Electrical Systems," by W. C. Woods, Westinghouse Electric Corp.

"System Neutral Grounding for the Petroleum Industry," D. D. Brereton and H. N. Hickok, General Electric Co.

"Motor Starting Problems in a Petroleum Refinery," by L. B. Eddy, Universal Oil Products Co.

Tuesday, September 13

"High Voltage Motor Controllers for the Petroleum Industry," by T. J. Render, General Electric Co.

"Lighting in a Petroleum Refinery," by Brice E. Gilman, Standard Oil Co. of Indiana.

"Insulated Cables and the Petroleum Industry," by E. E. McIlveene, Okonite Co.

"Installation and Maintenance of 13.8 KV Gas-Filled Cable Installation," by B. E. Crawford and J. A. Darden, Esso Standard Oil Co.

"Electric Power in Modern Gasoline Plant Construction," by E. A. Noser, Hudson Engineering Co.

ASME Petroleum Conference In 10th Annual Session

THE Petroleum Division of the American Society of Mechanical Engineers is divided into five committees — manufacturers, materials, production, refining, and transportation—and all of them will sponsor papers at the 10th Annual Petroleum Mechanical Engineering Conference, to be held at the Roosevelt Hotel, New Orleans, from September 25 to 28.

There will be a total of 32 technical papers and three panel discussions.

Morning sessions on Monday, September 26, the first day of meetings, will include papers on refining, production, transportation and materials. The afternoon will see a panel discussion on "Mechanics of Bulk Oil Measurement."

Tuesday will have a full day of technical sessions, and in the afternoon a panel on the ASME Unfired Pressure Vessel Code, as well.

Wednesday's sessions will continue until noon, the afternoon being devoted to a panel discussion on the ASA B31 Piping Code. This will conclude the conference.

Papers for Refiners at ASME-ASLE Lube Conference

THE American Society of Mechanical Engineers and the American Society of Lubrication Engineers will join for a second year to sponsor the Lubrication Conference. The Conference will be held at the Antlers Hotel, Indianapolis, Ind., from October 10 to 12.

The societies plan to make the conference an annual event. The session on lubricants scheduled for Tuesday, October 11, will have papers of particular interest to the petroleum refining industry. These are:

"Physico-Chemical Investigation of Engine Oil Performance," by A. Bondi, S. J. Beaubien and H. Diamond, Shell Development Co.

"Determining Grease Consistency With an Automatic Worker-Viscometer," by H. J. Connor, Westinghouse Research Laboratories.

"The Effect of Pressure and Temperature on the Viscosity of Lubricants: Part II, Application of Vogel's Equation," by R. B. Dow, Navy Bureau of Ordnance.

"Density-Temperature-Pressure Relations for Liquid Lubricants," by H. A. Hartung, Atlantic Refining Co.

"Predicting the Viscosity of Liquid Lubricants Under Pressure," by H. A. Hartung.

New York AIChE Schedules One-Day Symposium

CHEMICAL treatment of petroleum fuels and cost estimation are two of three topics to come under discussion October 20 at the one-day symposium being sponsored by the New York Section of the American Institute of Chemical Engineers. Site of the meeting is the Hotel Statler in New York City.

The session on cost estimation will run throughout the day, and concurrent with it in the morning will be the discussion of chemical treatment of petroleum fuels. In the afternoon there will be a session on unit operations.

The papers on chemical treatment of petroleum fuels will be these:

"Chemical Treatment of Gasoline and Gasoline Components," by H. Walker, Shell Oil Co.

"Chemical Treatment of Petroleum Fuels Heavier Than Gasoline," by W. W. Scheumann, Cities Service Research and Development Co.

"Naphtha Upgrading Under Hydrogen Pressure," by Marshall Sittig, Ethyl Corp.

"Hydrogen Treatment of Crude Oil and Petroleum Fuels Heavier Than Gasoline," by J. McAfee, Gulf Oil Corp.

Among the papers on cost estimation will be the following:

"Cost Estimating and Decision Making," by L. R. Steffens, Socony Mobil Oil Co.

"Comparison of Alternatives by Capitalized Cost," by F. C. Jelen, Allied Chemical & Dye Corp.

"Preparation of Operating Cost Estimates," by E. R. Swett, Singmaster & Breyer.

"Uncertainties of Cost Estimates," by W. L. Gore, Du Pont Co.

"Economics and Research Programming," by B. H. Rosen, Cities Service Research and Development Co., and A. L. Regnier, Petroleum Chemicals, Inc.

"The Exclusion Chart," by G. W. Zabel, Roger Williams Technical and Economic Services, Inc.

"High-Temperature Piping Costs," by R. M. Braca, Foster-Wheeler Corp.

Tour Scheduled for CNGA Annual Oct. 13-14

A FULL program including a tour of a research operation has been planned by the California Natural Gasoline Association for the general fall meeting October 13 and 14. The meeting, the 30th annual, will be held at the Ambassador Hotel in Los Angeles.

The first day will be devoted to technical forums, with panel discussions on such topics as the latest testing methods, maintenance procedures, plant installations and corrosion problems. On the second day the group will tour the Brea research facilities of the Union Oil Co. of California. A general meeting will conclude the event.

Only CONSECO Offers Such SERVICE

CONSECO SERVICE is two-fold. **On one hand, our engineers will design, redesign, build, erect, and install practically everything in a modern power or chemical processing plant except the building, electrical equipment, and turbo-generator. On the other hand, we will dispatch an expert crew to your plant for retubing, rebuilding, and maintenance of any type of tubular equipment, or metallizing . . . ANY HOUR, DAY or NIGHT, SUNDAYS and HOLIDAYS. Conseco's coordinated manufacturing and maintenance services meet every need in the Power and Processing fields.**

CONDENSER SERVICE & ENGINEERING CO., INC. CONSECO

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

54 Bloomfield Street
HOBOKEN, N. J.

Equipment Designed and Built by CONSECO

Conseco and its subsidiaries design, build, and install power and processing equipment and accessories, some of which are listed here. Purchasers of Conseco equipment benefit from our maintenance division's quarter century experience in rebuilding, modernizing, and maintaining our own as well as competitors' equipment. This coordination assures easy accessibility for maintenance and low operating cost. Send for bulletins covering equipment in which you are interested.

HEAT EXCHANGERS
CONDENSERS
EVAPORATORS
STEAM JET AIR EJECTORS
STEAM GENERATORS
PRESSURE VESSELS
CENTRIFUGES
FILTERS and STRAINERS
PUMPS, INSTRUMENTS, SPECIALTIES

Oil Man's Calendar

SEPTEMBER

Petroleum Industry Conference, sponsored by the American Institute of Electrical Engineers, Shamrock Hotel, Houston, Sept. 12-14.

Instrument Society of America, 10th national instrument conference and exhibit, Los Angeles, Sept. 12-16.

National Petroleum Assn., annual meeting, Traymore Hotel, Atlantic City, Sept. 14-16.

National Assn. of Corrosion Engineers, Montreal Section, corrosion symposium, Sheraton-Mount Royal Hotel, Montreal, Sept. 15-16.

Western Petroleum Refiners Assn., regional technical-industrial relations meeting, Casper, Wyo., Sept. 22-23.

American Institute of Chemical Engineers, Lake Placid Club, Lake Placid, N.Y., Sept. 25-28.

Petroleum Conference, American Society of Mechanical Engineers, Roosevelt Hotel, New Orleans, Sept. 25-28.

Independent Oil Compounders Assn., annual meeting, Bismarck Hotel, Chicago, Sept. 26-27.

Natural Gasoline Assn. of America, Oklahoma regional meeting, Skirvin Hotel, Oklahoma City, Sept. 29.

OCTOBER

American Society of Mechanical Engineers, petroleum branch, fall meeting, Roosevelt Hotel, New Orleans, Oct. 2-5.

American Society for Testing Materials, Committee D-2, petroleum products and lubricants, Statler Hotel, Washington, D.C., Oct. 2-6.

Lubrication Conference, sponsored by the American Society of Mechanical Engineers and the American Society of Lubrication Engineers, Antler's Hotel, Indianapolis, Ind., Oct. 10-12.

California Natural Gasoline Assn., fall meeting, Ambassador Hotel, Los Angeles, Oct. 13-14.

2nd Symposium on Vacuum Technology, Committee on Vacuum Techniques, Mellon Institute, Pittsburgh, Oct. 13-15.

American Gas Assn., annual convention, Los Angeles, Oct. 17-19.

American Institute of Chemical Engineers, New York Section, Hotel Statler, New York, Oct. 20.

Western Petroleum Refiners Assn., regional technical-industrial relations meeting, Garrett Hotel, El Dorado, Ark., Oct. 20-21.

Assn. of Consulting Chemists and Chemical Engineers, forum and annual meeting, Belmont Plaza Hotel, New York, Oct. 25.

Instrument Society of America, Philadelphia Section, "Automatic Control Loops—Electronic or Pneumatic?", Penn Sherwood Hotel, Philadelphia, Oct. 28-29.

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Oct. 31-Nov. 2.

NOVEMBER

Society of Automotive Engineers, golden anniversary diesel engine meeting, The Chase, St. Louis, Nov. 2-4.

Society of Automotive Engineers, golden anniversary fuels and lubrication meeting, Hotel Bellevue Stratford Philadelphia, Nov. 9-10.

American Petroleum Institute, annual meeting, Mark Hopkins, Fairmont, St. Francis, and Palace Hotels, San Francisco, Nov. 14-17.

American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit, Nov. 27-30.

TOWERS, TANKS AND PRESSURE VESSELS BY BROS

47-TON FRACTIONATOR

BROS

Steel Fabrications for the Changing Midwest Since 1882

For your petrochemical processing equipment, depend on the skills and facilities of Bros in Minneapolis — steel plate fabricator for the Midwest since 1882.

Fractionating towers, pressure vessels, stacks and storage tanks are some of the special fabrications of large and small capacities that Bros builds for refining crude oils into valuable synthetic chemicals. Above you see very recent Midwest installations constructed by Bros in its long tradition of exact conformance to blueprints and specifications.

Our engineering and research departments are staffed to provide you with expert assistance in the planning and design of process equipment. We have modern machine shop facilities for weldments and steel plate work from 3/16" to 1-1/2" thickness. Fabrications conform to all accepted code requirements. We also have X-ray and annealing facilities available.

When required, skilled Bros crews field erect units too large for such limiting conditions as shipping or building clearances.

Bros also builds and erects fuel oil tanks up to 20,000 bbl. capacity. We have a special 24-hour repair and maintenance service for your convenience. Our sales engineers are always ready to discuss your plant requirements for steel plate products.

General Sales Division

WM. BROS BOILER & MFG. CO.

1057 TENTH AVENUE S.E., MINNEAPOLIS 14, MINNESOTA

FIELD REPRESENTATIVES

STEEL PRODUCTS CORP.	WILLIAMS-SWANSON CO.	E. M. THOMPSON
52 Vanderbilt Avenue	503 Builders Exchange	950 Dierks Building
New York, N. Y.	Duluth, Minn.	Kansas City, Mo.

 (To obtain more data on advertised products see page 1472)

The most compact, reliable sampler ever built . . .

THE NEW Gilbarco

Small in size...
light in weight

AUTOMATIC SAMPLER

Here's a new compact, completely automatic, magnetically powered and electronically controlled sampler designed to provide a continuous sample from process or pipe lines.

USERS GET ALL THESE IMPORTANT ADVANTAGES.

- ★ Proportional to time or flow
- ★ Settings for 20 to 300 cycles per minute for more accurate sampling
- ★ No packing glands, no leakage
- ★ No electric motor, no mechanical switches
- ★ Simple to install and service
- ★ LOW initial cost . . . LOW maintenance cost
- ★ Completely explosion-proof . . . no pressure relief valves required
- ★ No hold-up time from pipe line to sample receiver; because a portion of the stream is by-passed through the sampler

Before you buy any other sampling unit, write for full details on this New Automatic Sampler.

GILBERT & BARKER MFG. CO. • WEST SPRINGFIELD, MASS. • TORONTO, CANADA

Process Economics Made Easy

Process Engineering Economics, Herbert E. Schweyer, 1955, 6½x9½ in., 409 pages, indexed, illustrated, stiff cloth cover, $7.50, McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N.Y.

Combining theory with practical examples, this book can serve both as a text and reference for students and as a reference for practicing engineers.

Not only is theoretical engineering economics covered, but so are accounting and finance data, cost estimations and evaluations of the economic feasibility of operations, and the economic balance to determine the optimum range of operations at lowest cost. New material on economic balance for chemical reactions is included, as well as a complete presentation of the differential treatment of break-even points and earning rates.

The author has attempted to present the basic economic and accounting techniques without an involved presentation of theoretical economics. The latter portion of the book illustrates these techniques by applying them to problems of various types.

Because of the size of the field covered by this one book, the author did not attempt to include all details of economics and accounting in the design and selection of equipment; therefore example problems have additional references listed.

Industry Helps Make Working Conditions Safe

Transactions of the 19th Annual Meeting of Industrial Hygiene Foundation, Transactions Bulletin No. 28, 1954, 6 x 9 in., 247 pages, table of contents, illustrated, paper cover, $5.00, Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

The thirty-four papers and round-table discussions published in the latest edition of the Industrial Hygiene Foundation's Transactions serve to emphasize the change in thinking that has come about during the last two decades concerning the health of industrial workers. When the Foundation was formed 19 years ago there was little public discussion of health hazards and working conditions. Today it has a membership of 365 companies representing almost every industrial category and having a total of more than 3 million employees.

During the year covered by the Transactions, 25 environmental surveys or medical audits took Foundation staff members into 81 plants.

Among the papers of possible interest to the petroleum and petrochemical industries are those covering the rehabilitation of injured employees, medical evaluation of noise, significance of industrial wastes, radioactive waste hazards, over-weight in industry, workmen's compensation legislation, toxicology of vanadium, hazards in welding and cutting, physicochemical dust suppression, oxidizing catalysts and air pollution control, plant ventilation by outdoor construction, and others.

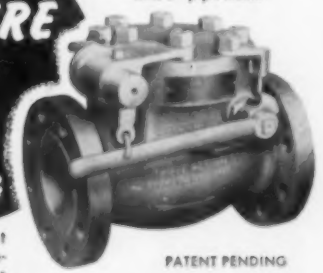
PHOENIX *Drop-Forged* FLANGES MEAN... MAXIMUM STRENGTH

Long life is assured with Phoenix maximum strength flanges. Forged of mild steel, they are available in a wide range of styles and sizes. Meet ASA requirements and ASME and ASTM specifications.

NEW CATALOG!
Send for free brochure showing Phoenix Complete Line.

FLANGE DIVISION
PHOENIX MANUFACTURING CO.
Catasauqua, Pa. • Joliet, Ill.

STOP FIRE FROM SPREADING



GREENWOOD Triple-Action Quick-Closing Valves are available in 1", 2", 3", 4", 6" and 8" pipe sizes.

PATENT PENDING

PLAY SAFE! Protect your plant and equipment from the damages of fire with GREENWOOD Triple-Action Quick-Closing Valves. Install them on all lines and tanks handling volatile or combustible products. Fire closes valve instantly (or valve may be remotely controlled in emergency). It's the cheapest kind of insurance.

Valves are regularly made of cast steel with stainless steel trim. Available for special services in monel, stainless steel or other alloys.

Valves may be closed three ways:
1. FIRE MELTS FUSIBLE LINK.
2. REMOTE MANUAL CABLE CONTROL.
3. APPLIED AIR PRESSURE OR AIR FAILURE.

Complete details in Bulletin GV-3—Write for your copy today.

Manufactured by GREENWOOD VALVE DIVISION
VERNON TOOL CO., LTD.
1101 MERIDIAN AVENUE • ALHAMBRA, CALIFORNIA

GREENWOOD TRIPLE-ACTION QUICK-CLOSING VALVE

AURORA
FIRST
WITH
Rexfo
TRADE

To meet the increasing demands for higher octane gasolines, Aurora Gasoline Company is installing facilities for the operation of the UOP Rexforming process—the first commercial installation of this newest catalytic reforming process.

The new facilities, to be installed at Aurora's Detroit, Michigan, refinery, will produce a high-octane blending component for the company's gasoline outlets. It is expected that the Rexforming unit will be placed in operation within the next five months.

The Rexforming process, capable of producing gasolines with octane ratings in excess of 100 clear, was developed by Universal Oil Products Company to provide the entire petroleum refining industry with a tool which will permit them to keep pace with the requirements for high octane motor fuels.

r m i n g

MARK

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD,
DES PLAINES, ILL., U.S.A.

Universal Service Protects Your Investment

Rugged, lightweight 6' sections are amazingly easy to handle.

New BETTER way to insulate BIG pipe

gb SNAP*ON

Recently, more than a mile of large 250° pipe was insulated at an eastern refinery in record time and at unprecedented low cost. The key to the success of the installation was revolutionary G-B Snap*On pipe insulation—one-piece molded cylinders of fine glass fibers.

Photos tell the story. Lightweight 6' sections of 20" Snap*On, 1½" in wall thickness, were hoisted to the job by a man with a rope. Unlike segmental pipe insulation, Snap*On required no springs or special tools for application. Two men accomplished the job quickly by snapping Snap*On sections snugly around the pipe and tracer line. A weatherproof jacket was applied in accordance with standard practice for outdoor installations. There was no breakage or waste, for flexible, resilient Snap*On is tough, does not break or crumble. No clean-up time was involved because Snap*On does not flake or chip.

Next time you have chilled or heated piping to insulate, if you want maximum thermal efficiency, easier application and permanence, specify G-B Snap*On. There is **nothing** like it!

Write for 8-page brochure or see the Yellow Pages for name of your local distributor who carries local stocks of Snap*On.

GUSTIN-BACON *Manufacturing Company* gb

Thermal and acoustical glass fiber insulations • Pipe Coverings and fittings • Railroad gaskets and supplies

266 W. 10th St., Kansas City, Mo.

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ADDITIVES, fuel oil, sludge preventing, brochure and sample of "Fuelguard;" Carlisle Chemical Works. See adv't. p. 1386.

AIR SEPARATION, oxygen-nitrogen, for low temperature processing, booklet; Air Products, Inc. See adv't. p. 1310.

ALUMINUM, for process industries, booklet; Alcoa Aluminum. See adv't. p. 1337.

ANALYSIS, of light hydrocarbons, booklet 82; Burrell Corp. See adv't. p. 1488.

BALL JOINTS, flexible, bulletin 215-B; Barco Mfg. Co. See adv't. p. 1432.

BARIUM CHEMICALS, for lube oil additives, booklet; Westvaco Mineral Products. See adv't. p. 1447.

BUBBLE CAPS, 300 styles listed in bulletin 22; Pressed Steel Co. See adv't. p. 1484.

CATALYST, boron trifluoride, information and uses; Baker & Adamson, Gen'l. Chemical Div. See adv't. Cover 3.

CATALYSTS, available in seven forms, booklet; Harshaw Chemical Co. See adv't. p. 1345.

CATALYTIC CRACKING units, fluid, flow diagram; M. W. Kellogg Co. See adv't. pp. 1356-1357.

CLAY, for protection against platinum catalyst poisoning, booklet; Minerals & Chemicals Corp. See adv't. p. 1431.

COMPRESSORS, gas and air, bulletin L-679-B1; Worthington Corp. See adv't. pp. 1320-1321.

CONDUIT, electrical, aluminum, booklet; Alcoa Aluminum. See adv't. p. 1456.

DEMISTER, vapor-liquid separation, catalog TL54, Otto H. York Co., Inc. See adv't. pp. 1324-1325.

DRUM RECONDITIONER, cleaning compound, booklet F7629R; Oakite Products, Inc. See adv't. p. 1500.

DRYING EQUIPMENT, for air, activated alumina type, booklet; Pittsburgh Lectrodryer Corp. See adv't. p. 1319.

DRYING EQUIPMENT, for gases and liquids, booklet; Selas Corp. of America. See adv't. pp. 1476-1477.

EXPANSION JOINTS, bulletin 351; Zallea Brothers. See adv't. p. 1305.

FITTINGS, forged steel, for high pressures, screw-end and welding types, 4 bulletins; Watson-Stillman Fittings Div. See adv't. p. 1347.

FLANGES, drop-forged, new catalog; Phoenix Mfg. Co. See adv't. p. 1465.

FLOW INDICATION, direct, bulletin 18A; Meriam Instrument Co. See adv't. p. 1443.

FLOW MEASUREMENT, bulletin 115-L1; Builders-Providence. See adv't. p. 1300.

INSULATION, cellular, literature and sample; Pittsburgh Corning Corp. See adv't. p. 1481.

INSULATION, industrial, wide temperature range, technical data; Owens-Corning Fiberglas Corp. See adv't. p. 1338.

INSULATION, industrial, pipe and molded block, folder, Philip Carey Mfg. Co. See adv't. p. 1355.

INSULATION, pipe, snaps on, brochure; Gustin-Bacon Mfg. Co. See adv't. p. 1468.

INSULATION, pipe, wide range of sizes, bulletin 109C; Union Asbestos & Rubber Co. See adv't. p. 1311.

INSULATION, plastic, available in colors, booklet; Armstrong Cork Co. See adv't. p. 1428A.

LIQUID BATCHING, automatic, bulletin F1-49; Hetherington & Berner, Inc. See adv't. p. 1494.

MATERIALS HANDLING, truck containers, information; Brooks Equipment & Mfg. Co. See adv't. pp. 1326-1327.

METAL DEACTIVATOR, to control copper compounds, technical data and samples; Tretolite Co. See adv't. p. 1428B.

METAL DEACTIVATOR, for military jet fuels, booklet; DuPont Co. See adv't. p. 1444.

METAL FABRICATION, and construction, booklet; Newport News Shipbuilding & Drydock Co. See adv't. p. 1501.

MIXERS, side and top entering, 8 catalogs available; Mixing Equipment Co. See adv't. p. 1358.

MIXERS, various types, catalog series 29; Eastern Industries, Inc. See adv't. p. 1491.

MOTOR STARTERS, for hazardous locations, booklet 1062; Electric Controller & Mfg. Co. See adv't. p. 1309.

PAINT, aluminum, aluminum-asphalt, booklets; Alcoa Aluminum. See adv't. p. 1343.

PIPE THREADER, geared, catalog; Ridge Tool Co. See adv't. p. 1498.

PROCESS ANALYZERS, refractometer, and infrared analyzer, bulletins CEC 1839-X12, CEC 1840-X12; Consolidated Engr. Corp. See adv't. p. 1313.

RECORDERS, small size, bulletin 13-18; Foxboro Co. See adv't. pp. 1306-1307.

REDUCING ELBOWS, welding, catalog 54; Midwest Piping Co. See adv't. p. 1333.

REFINERY FABRICATION, general catalog; Flint Steel Corp. See adv't. p. 1490.

Let's Talk About

Sealing Service

DURAMETALLIC is ready to help you with those stuffing box problems . . . we've been doing it for industry for 38 years. Experienced factory-trained sales and service engineers are located in all sections of the U.S.A.

Without charge, a staff of research and development engineers at our Kalamazoo plant are ready to help you with your sealing needs.

When seeking an answer to satisfactory sealing . . . put it up to Durametallic.

Write Today for Bulletin File No. DM-PP

DURAMETALLIC CORPORATION

KALAMAZOO, MICHIGAN

CLASSIFIED

UNDISPLAYED RATE

$1.50 a line. Minimum 3 lines. Box numbers count one additional line.

POSITION WANTED. Undisplayed rate is one half of above rate, payable in advance.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads.

DISPLAYED RATE

The advertising rate is $13.50 per inch for Equipment and Business Opportunity advertising appearing on other than a contract basis. Contract rates quoted on request.

EMPLOYMENT OPPORTUNITIES

$13.50 per inch, subject to agency commission. AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

Send NEW ADVERTISEMENTS to Classified Advertising Division, PETROLEUM PROCESSING, *330 W. 42nd St., N. Y. 36, N. Y. October issue closes September 14th.*

(Additional Classified Advertising on opposite page)

LIKE NEW CONDITION—WAR SURPLUS

(6) WHITE 10-TON 6 x 6 ALL WHEEL DRIVE FIRE TRUCKS

AEROPLANE CRASH TRUCKS

EQUIPPED WITH 750 GPM AMERICAN LAFRANCE PUMP, 1000 GAL. CAP. RESERVE TANK

Fully equipped . . . 11:00 x 20 tires . . . Ideal for refinery fires . . . Equipped with overhead turret guns and nozzles to blanket complete airplane fire . . . Acquisition cost to the Government, $35,000 each. Also, can furnish 10-ton Cardox fire fighting truck, fully equipped. *Will sell on rental purchase plan.*

Will work with agents

Exceptional Buy!

$4500 Each F.O.B. ATLANTA

CALL, WIRE OR WRITE

FULTON AUTO EXCHANGE

2235 Stewart Ave., S.W. Atlanta, Ga. Telephone FAirfax 8606

Information Offered

REFRACTORY LININGS, hydraulic setting, gun or trowel, brochure RC-28A; Johns-Manville. See adv't. p. 1496.

SEAL, shaft, "Teflon," bulletin MS-954; U. S. Gasket Co. See adv't. p. 1299.

SEALS, for stuffingboxes, bulletin DM-PP; Durametallic Corp. See adv't. p. 1470.

STEAM TRAPS, impulse type, catalog; Yarnall-Waring Co. See adv't. p. 1495.

STORAGE TANKS, catalog 54B; Hammond Iron Works. See adv't. p. 1475.

SULFUR ANALYSIS, in petroleum products, combustion unit, bulletin LEP-1; Lindberg Engineering Co. See adv't. p. 1434.

TERMINAL FACILITIES, booklet describes operation; Hess Terminal Corp. See adv't. p. 1478.

TUBE EXPANDER, parallel rolling type, bulletin 3400; Gustav Wiedeke Co. See adv't. p. 1494.

TUBE FITTINGS, for instrumentation lines, 2 catalogs; Parker Appliance Co. See adv't. p. 1497.

TUBE FITTINGS, many types, catalog; Crawford Fitting Co. See adv't. p. 1430.

TUBING AND PIPE, for high pressures, bulletin 6; Babcock & Wilcox Co. See adv't. p. 1499.

TUBING, condenser, booklet and catalog; Wolverine Tube. See adv't. pp. 1348A-1348B.

VACUUM CLEANER, for hazardous locations, specifications on request; Doyle Vacuum Cleaner Co. See adv't. p. 1328.

VALVES, plug, reference book 39-3; Homestead Valve Mfg. Co. See adv't. p. 1482.

VALVES, quick closing, for fire protection, bulletin GV-3; Vernon Tool Co. See adv't. p. 1465.

THE DOW CHEMICAL COMPANY
TEXAS DIVISION
FREEPORT, TEXAS

Offers Opportunities for:

ORGANIC CHEMISTS
ANALYTICAL CHEMISTS
POLYMER CHEMISTS
PHYSICAL CHEMISTS
CHEMICAL ENGINEERS
MECHANICAL ENGINEERS

with

B.S., M.S., Ph.D. Degrees

0 to 5 Years Experience

Positions available for qualified candidates in Organic and Inorganic Research, Development, Organic and Inorganic Production, Process and Plant Design, an Analysis.

Moving Expenses Paid
Good Housing Conditions

Qualified applicants please submit resume and record of college work to:

D. M. Duguid
The Dow Chemical Co.
Freeport, Texas

MAN HUNTERS

If you are looking for personnel on the executive level, there is no better way than through the more than 16,500 subscribers of this publication. You can make contact with them quickly, easily, and economically through PETROLEUM PROCESSING's classified section.

THE STANDARD OIL COMPANY (OHIO)

Manufacturing (Refining) Department

is looking for

CHEMICAL ENGINEERS, CHEMISTS, and MECHANICAL ENGINEERS

with one to five years experience in petroleum refining or related activities
for staffwork primarily in Cleveland, Ohio.
Possible employment in Toledo, Lima, or Cincinnati, also.

Applicant should have the following educational background and industrial experience:

Chemical Engineers: B.S. or higher degree and experience in development, pilot plant operation, process design, process trouble shooting, refinery process engineering, economic studies, or related work background.

Chemists: B.S. or higher degree and experience in product and process research or development.

Mechanical Engineers: B.S. or M.S. degree and experience in process equipment construction, design, inspection, or maintenance, petroleum product testing and field evaluation, or related work background.

Age range 22 - 32

Salaries commensurate with experience and level in organization. Advance on merit basis.

If you can qualify and are looking for a permanent job with a growing but secure midwest company, write, giving full information on education, industrial experience, military experience, and personal data to E. G. Glass, Jr., 1737 Midland Building, Cleveland 15, Ohio.

ENGINEER
OIL REFINERY

The men we are looking for should have imagination and initiative, should be able to get along with people, and should be the type that gets things done. They should be men qualified either for process development or designs engineering and who like to combine field and desk work. Chemical or mechanical engineers with high scholastic standing preferred. Previous experience in oil refinery engineering or related fields while not essential, would be desirable. The openings we have are important and stimulating. Opportunities for advancement are excellent, as are the benefits and working conditions we provide. Located in Metropolitan New Jersey area.

P-7164 Petroleum Processing
330 W. 42 St. New York 36, N.Y.

STEEL PIPE & TUBING

• CHROME MOLY • CARBON MOLY
• MONEL • CARBON STEEL • STAINLESS
Widest Range of Sizes & Specs in the U.S.
WRITE FOR STOCK LIST
Send us your Surplus Lists
MIDCONTINENT TUBE SERVICE, INC.
2308 Oakton St., Evanston, Ill. DA 8-4030

CHEMICAL AND PETROLEUM SPECIALIST AS PRODUCT APPLICATIONS ENGINEER

Kaiser Aluminum—one of the nation's three largest fully integrated producers of aluminum—offers product applications position for well-qualified engineer with chemical and petroleum background. An intimate knowledge of the chemical and petroleum industries is required.

The product applications engineer will promote the development of new applications for aluminum in the chemical and petroleum industries. Involves travel on a national basis to contact key personnel in the chemical and petroleum industries. Will be located at national headquarters, Chicago.

Salary commensurate with experience. Please submit personal resume describing previous experience and indicating present and required salary to:

R. E. BANKERT
KAISER ALUMINUM & CHEMICAL SALES, Inc.
919 North Michigan Avenue
Chicago 11, Illinois

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products, or services which interest him. This code letter appears in parentheses following the advertiser's name.

•

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries promp and efficient handling.

Airetool Mfg. Co. (I-6) 1454
Air Preheater Corp. (F-5) 1349
Air Products, Inc. (B-7) 1310
Aluminum Co. of America, Electrical Products (I-8) 1456
Aluminum Co. of America, Pigments Div. (E-7) 1343
Aluminum Co. of America, Process Equipment (E-2) 1337
American Cyanamid Co., Refinery Chemicals Dept. (I-2) 1449
Anaconda Co. (M-3) 1493
Annin Co. (I-4) 1451
Armstrong Cork Co., Inc. (G-5) 1428A

Babcock & Wilcox Co., Tubular Products (N-3) 1499
Babcock & Wilcox Co., Boiler Div. (E-8) 1344
Badger Mfg. Co. (J-1) 1304
Baker & Adamson, Gen'l Chem. Div. (N-7) Cover 3
Barco Mfg. Co. (G-9) 1432
Barrett Mfg. Co. (M-8) 1496
Bingham Pump Co. (F-1) 1346
Black, Sivalls & Bryson, Inc. (L-1) 1483
Brooks Equipment & Mfg. Co. (D-2) 1326-1327
Bros Boiler & Mfg. Co., Wm. (B-1) 1463
Brown Fintube Co. (I-9) 1457
Builders-Providence, Inc., Div. B-I-F Indus. (A-9) 1300
Burrell Corp. (L-7) 1488

Carey Mfg. Co., Philip (F-9) 1355
Carlisle Chemical Works, Inc. (G-4) 1386
Catalytic Construction Co. (D-8) 1334
Chicago Bridge & Iron Co. (C-5) 1318
Cities Service Co. (F-8) 1354
Coridenser Service & Engr. Co. (J-4) 1462
Consolidated Engr. Corp. (C-1) 1313
Cooper-Bessemer Corp. (E-4) 1339
Crane Co. (G-3) 1384
Crawford Fitting Co. (G-7) 1430
Crosby Steam Gage & Valve Co. (A-3) 1286-1287

Dowell, Inc. (C-3) 1315
Doyle Vacuum Cleaner Co. (D-3) 1328
DuPont Co. (B-2) 1304A-1304B
DuPont Co. (H-7) 1444
Durametallic Corp. (K-2) 1470

Eastern Industries, Inc. (M-1) 1491
Electric Controller & Mfg. Co. (B-6) 1309
Enjay Co. (I-5) 1452
Ethyl Corp. 1382-1383

Fisher Governor Co. (D-5) 1330-1331
Flint Steel Corp. (L-9) 1490
Foster Wheeler Corp. (E-5) 1340-1341
Foxboro Co. (B-4) 1306-1307

Gen'l. Amer. Trans. Corp., Plate & Welding Div. (A-4) 1290
Gen'l. Amer. Trans. Corp., Terminals Div. (A-5) 1292
General Refractories Co. (C-9) 1323
Gilbert & Barker Mfg. Co. (J-6) 1464
Graver Tank & Mfg. Co. (A-7) 1296
Gustin-Bacon Mfg. Co. (K-1) 1468

Hammond Iron Works (K-3) 1475
Harshaw Chemical Co. (E-9) 1345
Hercules Powder Co. (C-8) 1322
Hess Terminal Corp. (K-5) 1478
Hetherington & Berner, Inc. (M-4) 1494
Homestead Valve Mfg. Co. (K-9) 1482
Hudson Engineering Corp. (A-1) Cover 2

International Nickel Co. (E-6) 1342

Johns-Manville Corp. (M-7) 1496

Kellogg Co., M. W. (G-1) 1356-1357
Koch Engineering Co. (H-4) 1438
Kuljian Corp. (M-2) 1492

Lindberg Engineering Co. (H-2) 1434
Lukens Steel Co. (I-7) 1455
Lummus Co. (A-6) 1295

McKee Co., Arthur G. (H-1) 1433
Meriam Instrument Co. (H-6) 1443
Midvale Co. (K-6) 1479
Midwest Piping Co. (D-7) 1333
Minerals & Chemicals Corp. (G-8) 1431
Mixing Equipment Co. (G-2) 1358

National Aluminate Corp. (J-3) 1460
Newport News Shipbuilding & Drydock Co. (N-5) 1501
Nicholson & Co., W. H. (J-5) 1458
Nitrogen Div., Allied Chem. & Dye Corp. (C-2) 1314
Norton Co. (H-5) 1440

Oakite Products, Inc. (N-4) 1500
Ohio Apex Div. (L-3) 1484
Oilwell Supply Co. (A-2) 1285
Oronite Chemical Co. (L-5) 1486
Owens-Corning Fiberglas Corp. (E-3) 1338

Parker Appliance Co. (N-1) 1497
Petro-Chem Development Co., Inc. (F-3) 1348
Petreco (D-4) 1329
Petroleum Week (F-7) 1352-1353
Phoenix Mfg. Co. (J-7) 1465
Pittsburgh Corning Corp. (K-8) 1481
Pittsburgh Lectodryer Corp. (C-6) 1319
Powell Co., Wm. (L-6) 1487
Pressed Steel Co. (L-2) 1484
Procon, Inc. (L-8) 1489

Reynolds Metals Co. (D-9) 1335
Rhodia, Inc., Alamask Div. (I-3) 1450
Ridge Tool Co. (N-2) 1498
Rockwell-Nordstrom Valves (N-6) 1502-1503

Sauereisen Cements Co. (M-9) 1496
Scientific Design Co., Inc. (D-6) 1332
Selas Corp. of America (K-4) 1476-1477
Shell Oil Co. (L-4) 1485
Sier-Bath Gear & Pump Co., Inc. (I-1) 1448

Taylor Instrument Cos. (F-6) 1350-1351
Tennessee Corp. (H-3) 1437
Tickle Engr. Works, Arthur (H-8) 1446
Tretolite Co. (G-6) 1428B

Union Asbestos & Rubber Co. (B-8) 1311
U. S. Gasket Co. (A-8) 1299
Universal Oil Products Co. (C-4) 1316-1317
Universal Oil Products Co. (J-9) 1466-1467

Vernon Tool Co., Ltd. (J-8) 1465
Vogt Machine Co. (K-7) 1480

Warner Lewis Co. (J-2) 1459
Warren Petroleum Corp. (B-5) 1308
Watson-Stillman Fittings Div., H. K. Porter Co. (F-2) 1347
Western Supply Co. (B-9) 1312
Westvaco Mineral Prods. (H-9) 1447
Wiedeke Co., Gustav (M-5) 1494
Wolverine Tube, Div. Calumet & Hecla, Inc. (F-4) 1348A-1348B
Worthington Corp. (C-7) 1320-1321
Wyatt Metal & Boiler Works (N-8) Cover 4

Yarnall-Waring Co. (M-6) 1495
York Co., Inc., Otto H. (D-1) 1324-1325

Zallea Brothers (B-3) 1305
Zink Co., John (E-1) 1336

CLASSIFIED ADVERTISING
F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES 1471
EQUIPMENT (Used or Surplus New) For Sale 1470-1471

SAVE TIME • SAVE EFFORT • KEEP INFORMED

USE THIS CARD . . .

to secure information on products and services advertised in *Petroleum Processing* or reviewed in its *"What's New"* section.

FOR ADVERTISED PRODUCT INFORMATION:
Check the Advertiser's Index for advertisement's code letter. Then circle the corresponding code letter on the card below.

FOR "WHAT'S NEW" PRODUCT INFORMATION:
Circle the code number on the card below which corresponds to the number listed at the end of that specific "What's New" item.

THEN:
Fill in your name, position, company and mailing address. Mail the card . . . no postage is required.

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER DECEMBER 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

9/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER DECEMBER 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

9/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

FOR MORE INFORMATION...

about products and services advertised in this issue of Petroleum Processing or reviewed in its "What's New" section, use the postage-free cards provided below.
(See other side for complete instructions.)

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in the United States

4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in the United States

4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

WHAT'S NEW...

The What's New section this month starts on p. 1404—a special section of 56 items selected for their particular interest to the petrochemical field.

Catalytic Waste-Heat Boilers

Sun Oil Co.'s two new Houdriflow catalytic crackers—one at Toledo, Ohio and one at Marcus Hook, Pa.—use catalytic waste-heat boilers to burn their own flue gases. Thus over 100,000 lb./hr. of process steam, equivalent to about 110,000,000 Btu/hr., is produced without the need for outside fuel, and the flue gases are converted into carbon dioxide and water vapor before discharge into the atmosphere, reducing the possibility of air pollution.

The waste-heat boiler catalyst is "Oxycat," developed by Eugene J. Houdry who first developed catalytic cracking about 20 years ago. Each Oxycat is a brick-size structure consisting of 71 slender porcelain rods suspended between two square porcelain end plates. A thin catalytic coating on the rods oxidizes the carbon monoxide and hydrocarbon oil vapors in the cat cracker exhaust to form a clean effluent of carbon dioxide and water vapor.

The waste-heat boilers at Sun's two refineries—the first Oxycat units to be built as an integral part of a refining plant—are the potential source of a $400,000 a year fuel saving (the cost of the 150,000 bbl. of fuel oil that would be required to generate the same amount of heat) and cost only $800,000 to build as compared to a total investment of $20,000,000 for the two cat crackers. Thus the Oxycat waste-heat boilers will pay for themselves in two years. Oxy-Catalyst, Inc., Wayne, Pa.

Circle No. **57** *on Reply Card*

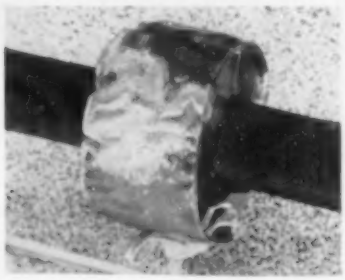
For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.

Ammonia Detector

. . . **consists of booklet** containing paper strips impregnated with phenolphthalein. By tearing a strip from the book, saturating it with water and holding it near suspected leaks, the user can detect the presence of ammonia when the color of the paper turns red. The "Ammonia Leaks Test Paper" may be obtained free from Nitrogen Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

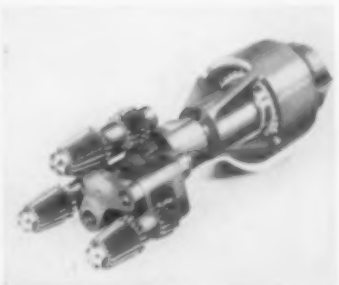
Circle No. **58** *on Reply Card*



Valve and Flange Covers

. . . **give "color" warning** when struck by leaking chemicals. The "Spray-Stop" is recommended for use on chemical-carrying pipelines, and is unaffected by fumes. The cover allows anyone in the vicinity to observe the "color-change" warning of a leak, yet prevents sudden pipeline leaks from spraying harmful liquids onto nearby workers and equipment by deflecting the chemical to the ground. Neirad Industries, Inc., P. O. Box 865, 1 Post Road, Darien, Conn.

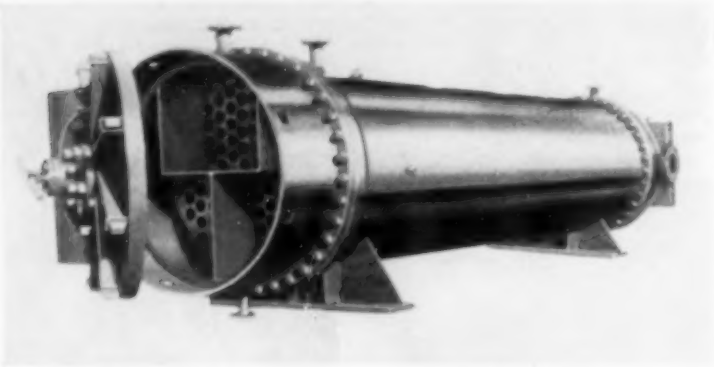
Circle No. **59** *on Reply Card*



Tube Cleaner Motor

. . . **is water-driven** and has ball-bearing construction. For application in plants where air and steam are not available, the motor is designed to use either high or low pressure water sources. The shortness of the motor and its cleaning or expansion head aids work on curved tubes. Applications can be for tubes in sizes from 1¼ to 4-in. I.D. The Airetool Mfg. Co., 304 S. Center St., Springfield, Ohio.

Circle No. **60** *on Reply Card*



spray" will cover the width of a standard horizontal cooling tower section without water loss, and on vertical coils it gains maximum efficiency by the use of dual baffle boards. The spray offers no restriction to the flow of water from the 1-in. discharge pipe to which it is attached. The streamlined shape of the revolving rotor minimizes tendencies for foreign matter to hold on its surface. Metal parts are electro-polished stainless steel. The rotor is molded from nylon. Permissible ambient temperatures are from —50 to +250° F. N. C. Stearns Co., P. O. Box 1234, Shreveport, La.

Circle No. **63** *on Reply Card*

Exchanger "Door" Speeds Maintenance

A self-seating, quick-opening door considerably reduces the time needed to open heat exchangers, autoclaves, sterilizers and other pressure vessels.

The "p-k Lever-Lock Door" is locked and unlocked by means of bars. The door is particularly recommended for use of heat exchangers requiring frequent entry for cleaning and inspection due to fouling. Capable of withstanding temperatures from —70 to +400°F., and pressures from full vacuum to 300 psi., a 60° turn with a 15 lb. pull opens the door.

The lock has a tight-fitting closing gasket and automatically seats when closed. A mechanical lock safety device prevents the door from being opened while the vessel is under pressure.

The door may be closed on either horizontal or vertical installations, and pneumatic lifting mechanisms may be used, as large door models weigh close to 300 lb. Fabrication can be to meet all code requirements. The Patterson-Kelley Co., Inc., 10 Lackawanna Ave., East Stroudsburg, Pa.

Circle No. **61** *on Reply Card*

Phosphorus Pentasulfide

. . . **used as an intermediate** for manufacture of thiophosphates for oil and grease additives, flotation agents, insecticides, etc. is now available from a new process. The distilled phosphorus pentasulfide is made with pure electric furnace phosphorus and is being marketed as a greenish-yellow granular powder. Typical analysis is 27.9% phosphorus, 72.0% sulfur, and a melting point of about 280°C. The P_2S_5 is also available in solid form. Powdered material is packed in 150 and 325 lb. drums. Inorganic Chemicals Div., Monsanto Chemical Co., St. Louis 1, Mo.

Circle No. **64** *on Reply Card*

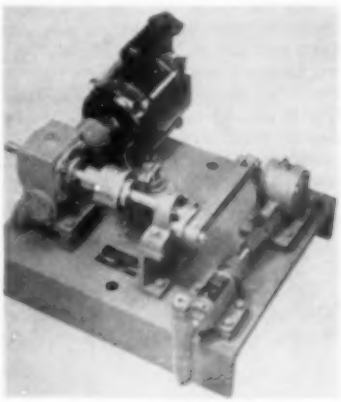
Solvent Welding PVC Fittings

. . . **made of injection molded** unplasticized polyvinyl chloride are said to be the first fittings and flanges produced on a commercial scale by the injection molding process. Solvent welding fittings permit fast, easy installations with a minimum of tools and equipment, and are recommended for permanent installations whereas threaded fittings are recommended where future disassembly will be required. These are in addition to the regular line of threaded fittings, with both lines including 90° and 45° elbows, tees, unions, couplings, caps, reducing bushings and flanges. Tube Turns Plastics, Inc., 224 E. Broadway, Louisville 1, Ky.

Circle No. **62** *on Reply Card*

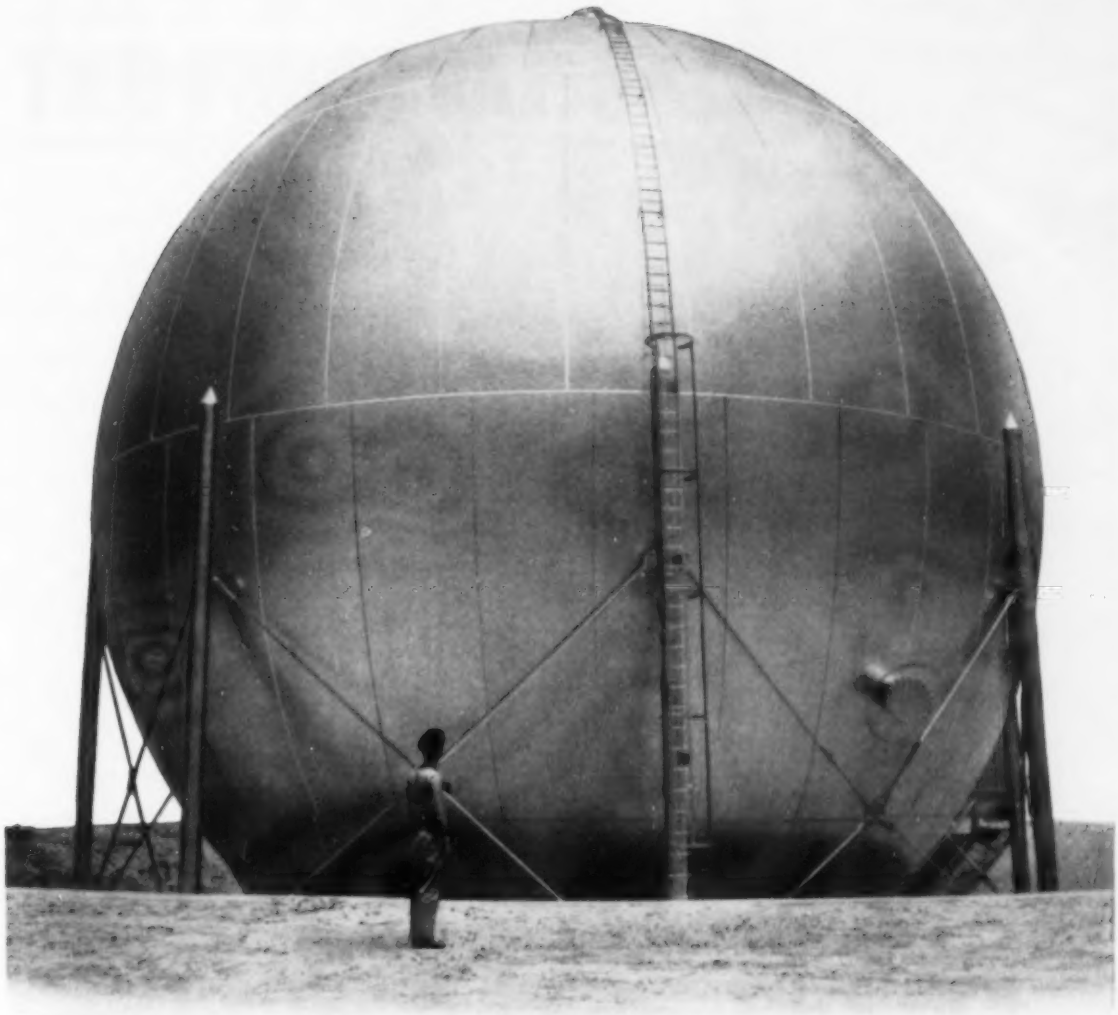
Cooling Tower Spray Head

. . . **has revolving rotor** to produce a controlled spray of evenly divided water particles at 5 psig. The "Gyro-



Flow Metering Pump

. . . **has positive displacement** action and is solenoid-clutch operated. Called the "UMC," the pump is primarily for metering and proportioning additives and odorants to fuel and natural gas lines. The single revolution solenoid operated clutch permits one stroke of the pump plunger in response to an electric signal which may be timed to effect a feed rate to the main flow line



PREPARING FOR THE ATOMIC AGE

The above true sphere, the largest of its kind in the U.S., is an important element in a vital research project.

Ask for Catalog 548

HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH • CASPER, WYO. • BIRMINGHAM, ALA.

Sales Offices: NEW YORK 20 • AKRON • BOSTON 10 • BUFFALO 2 • CHICAGO 3 • CINCINNATI 2 • CLEVELAND 15 • EL PASO • HOUSTON 2 • LOS ANGELES 14 • PITTSBURGH 19 RICHMOND 20 • SAN FRANCISCO • WASHINGTON 6, D.C. • HAVANA • "TIPSA" BUENOS AIRES

SELAS EQUIPMENT

Ethylene production by pyrolysis of light hydrocarbons—a 14-million Btu per hour Gradiation unit. Photo: Phillips Petroleum Co., Rice Plant, Borger, Texas.

Zone Control

GIVES Phillips 66 VERSATILITY

IN ETHYLENE PRODUCTION

Maximum product yield for any given feed stock . . . yet capable of handling extreme variations in feed stock . . . these are the outstanding features of Selas Zone Control in the production of ethylene at Phillips Petroleum Company.

Butane, propane or ethane are processed with equal ease at optimum conditions . . . through the same Selas Gradiation furnace . . . with exceptionally long runs. Average on-stream periods in excess of 60 days, at conversions of 65% ethane are obtained.

Other benefits of Selas Zone Control . . . whether your petroleum refining, petrochemical or chemical processing operations involve critical pyrolysis reactions, controlled catalytic reactions in packed tubes or high temperature preheating . . . are as follows:

- Uniform peripheral heat distribution around the tubes assures elimination of local overheating . . . minimized material degradation at the tube wall . . . greater tube life.
- Zones of controllable heat input produce the desired time-temperature curve . . . permit most effective use of the surface provided.
- Controlled combustion means no external oxidation of the tubes . . . no lag in response to controller demand.

Send for informative bulletin "Gradiation Heating for Petroleum and Chemical Processing" and article reprint, "Try the Gradiation Heater for Economical Ethylene Production."

SELAS
CORPORATION OF AMERICA
PHILADELPHIA 34, PENNSYLVANIA

FLUID PROCESSING

SELAS

FOR FLUID PROCESSING

CONTINUOUS AUTOMATIC DRYING OF COMPRESSED AIR, PROCESS GASES AND LIQUIDS

Selas Dehydrators are designed for all conditions of processing, to effectively and economically dry gases and liquids.

Compressed air, carbon monoxide, hydrogen, oxygen, gaseous hydrocarbons, inert gases are dried efficiently.

Numerous liquids . . . including propane, butane, kerosene, benzol, toluene, xylene and solvent naphthas . . . are also dried.

- Desiccants employed are selected to meet moisture-removal requirements.
- Reactivation by steam, gas or electric heat.
- Operating pressures range from atmospheric to 6000 psig.

Selas Dehydrators are available for manual, semi-automatic and fully automatic operations. Capacities range to 15,000 scfm for gases, and up to 200 gpm for liquids.

Write for informative bulletin on "AIR-GAS PROCESSING."

Semi-automatic, continuous-duty Selas Dehydrator, capacity 14,500 scfm air at 150 psig.

Other SELAS Fluid Processing Equipment

LIQUID-GAS SEPARATION

Continuous automatic removal of water, water-oil emulsions and dirt from compressed air and process gases (nitrogen, hydrogen, oxygen, fuel gases); continuous automatic removal of condensate, oil, dirt and other impurities from steam. Available in capacities from 10 to 5000 scfm; pressures from 25 to 3500 psi.

HYDROCARBON VAPOR ADSORPTION ...*plus* LIQUID-GAS SEPARATION

Continuous removal of hydrocarbon vapors, liquid hydrocarbons, water-hydrocarbon emulsions and dirt from compressed air and process gases (nitrogen, hydrogen, carbon dioxide, inert gases). Available in capacities from 100 to 5000 scfm, at inlet pressures up to 3500 psi.

LIQUID-LIQUID SEPARATION

Continuous separation of emulsions in steam distillations, solvent extractions, organic reactions. Dewatering of solvents and hydrocarbons; recovery of organic liquids.

Capacities of single units range from 10 to 6000 gph.

 (To obtain more data on advertised products see page 1472)

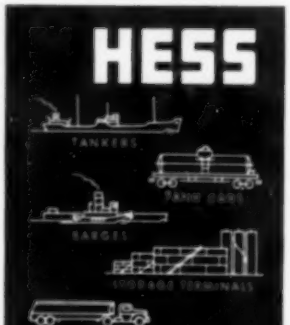
Protection from CONTAMINATION

through PRODUCT PRIVACY!

When you store chemicals, petrochemicals, petroleum products or other bulk liquids at the modern HESS storage terminals in New York Harbor or on the Gulf Coast, you store with confidence. Absolute protection from contamination is assured through complete product privacy. Individual tanks can handle quantities from 10,000 to 10,000,000 gallons, receiving and shipping through separate product piping, pumping and drumming facilities.

The key to more than 400,000,000 gallons of storage capacity is yours without one cent of capital investment. Twenty-four hour–a–day service, plus tanker, barge, tank car, transport, truck and drum facilities, gives you all the advantages of your own storage plant with none of the headaches.

You'll like doing business with HESS. Write for your copy of new illustrated book telling the whole story of how your product will be handled and stored. Please address your inquiry to our location nearest you so that we can give it immediate attention.

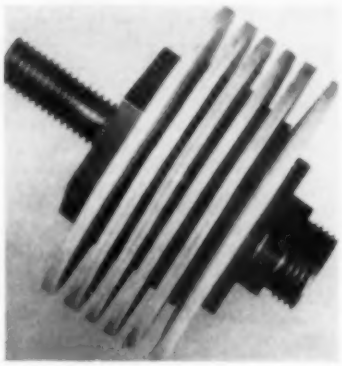


HESS, INCORPORATED
Perth Amboy, N. J.
VAlley 6-1000

HESS TERMINAL CORP.
Houston, Texas
Glendale 37195

at regularly timed intervals. Electrical impulses can originate from a mechanical flow meter, differential meter, gravimetric meter, program timer, etc. The pump is available in maximum capacities of from 0.10 gph to 20 gph per feed. Single feed is standard, but two-feed units are available. Operating pressures are to 5,000 psi. Hills-McCanna Co., 3025 N. Western Ave., Chicago 18, Ill.

Circle No. **65** *on Reply Card*



Porous Plastic Filters

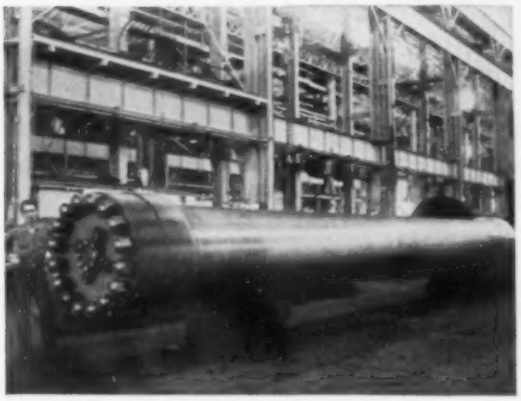
. . . are made of Teflon and Kel-F in a new design reducing the price of in-line filters. The filters are of welded construction with molded flow passages, and are designed for easy disassembly and cleaning. A square foot of filter area is contained in a volume 2 in. high and 3½ in. O.D. Sizes up to 10 sq. ft. have prices 55% lower than old style units. Porous Plastic Filter Co., Glen Cove, N. Y.

Circle No. **66** *on Reply Card*

Resistance Thermometer

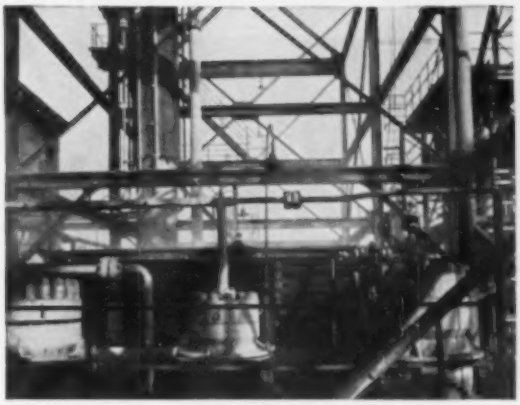
. . . is accurate at high temperatures. The "Model 242P" is manufactured to give accuracies of ±½% (of temperature) from 32° F. to 600° F. and ±1% from 600° F. to 1300° F. The resistance changes from 100 ohms at 32° F. to 359 ohms at about 1380° F. The unit can be connected to a remote control panel through ordinary copper wire with no limitation to the length of the wire. The element is hermetically sealed in a corrosion-resistant steel alloy tube and terminates in three leads. The third lead is provided to bring power directly to the resistance element and thus nullify any effects from lead wire resistance. The maxi-

MIDVALE MAKES IT STRONG FOR AMMONIA



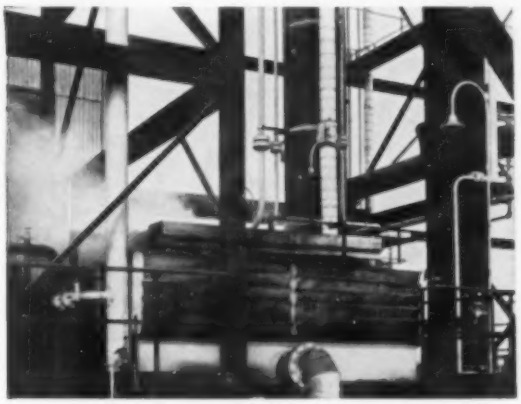
VESSELS START *RIGHT*

. . . at the Midvale furnace. The heads and the body of this ammonia converter were made from a combination of electric and open-hearth heats. This is typical of the ways in which Midvale uses its vast facilities to meet customer specifications.



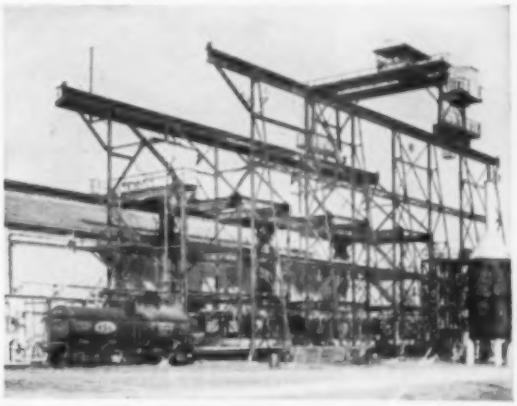
A FLAT HEAD AT EACH END

. . . requires leak-proof joints. Stud-bolts, 3¼" in diameter, hold these closures in place, and "delta type" gaskets . . . self-sealing under pressure . . . keep the joints tight. Midvale's close-tolerance, fine-finish machining of seat and gasket make such joints effective for the high pressures involved.



EXPERIENCE

. . . is necessary to produce this 42'7" vessel . . . shaped by equally experienced Midvale workmen who draw upon a half century of the company's experience in forging, and heat treated in closely controlled furnaces to develop physical properties capable of withstanding high working pressures.



THE COMPLETE PICTURE

. . . of Midvale has been developed through years of experience in making forged steel pressure vessels of many kinds . . . converters, reactors, separators, autoclaves. Midvale has men and equipment to make them to your specifications—for corrosion resistance, high temperatures and high pressures. Call Midvale next time. Let our engineers work with you from planning to installation.

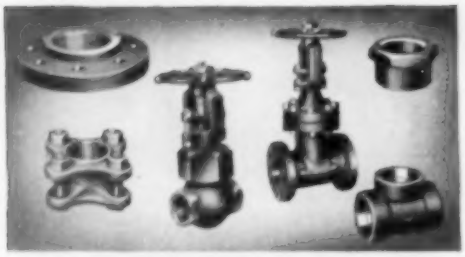
THE MIDVALE COMPANY- Nicetown, Philadelphia 40, Pa.

Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

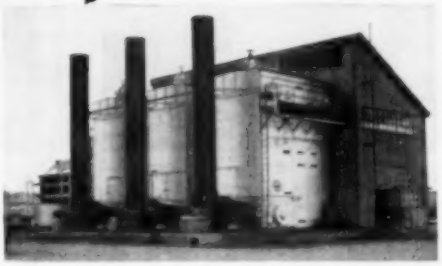
Forgings, Rolls, Rings, Flanges, Corrosion and Heat Resisting Castings

Designed for today's *Tough* service demands



DROP FORGED VALVES AND FITTINGS FOR TOUGHNESS AND TROUBLE-FREE SERVICE

Drop forged from carbon and alloy steels, Vogt valves, fittings and flanges will safely handle liquids and gases at high pressures and high temperatures in power plants, chemical plants, petroleum refineries, etc. The complete line includes flanged, screwed and socket weld end globe, gate and check valves—ells, tees, and crosses—couplings—bushings—plugs—unions—flanges and flange unions—and welding heads.



MODERN STEAM GENERATORS

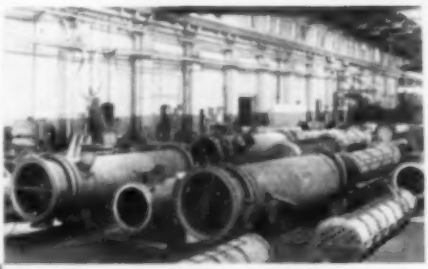
Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels meet every power, process or heating requirement.

PROCESS EQUIPMENT FOR EVERY SERVICE

Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.

SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.



MORE REFRIGERATION TONNAGE AT LESS COST

More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Absorption Systems, Compression Systems, and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants, and institutions, here and abroad.

Vogt

PRODUCTS

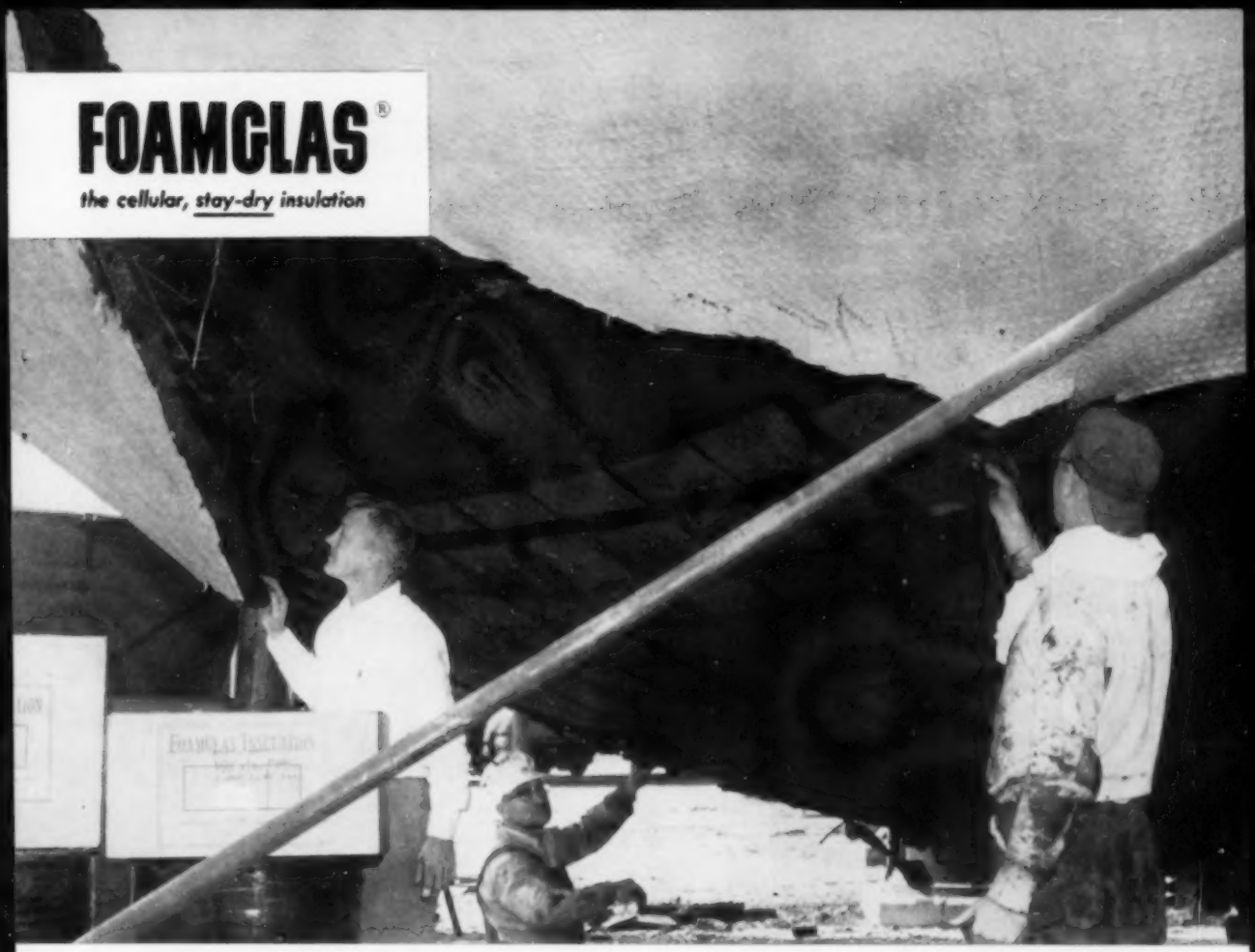
FOR REFINERIES, CHEMICAL PLANTS POWER PLANTS AND PROCESS INDUSTRIES

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KY.

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland St. Louis, Dallas, Charleston, W. Va.

FOAMGLAS®

the cellular, stay-dry insulation



Mississippi Chemical Corporation reports . . .

"Long-lasting, stay-dry FOAMGLAS replaced failed organic insulation on our ammonia storage sphere"

Organic insulation on a 34°F. ammonia storage sphere failed in less than 4 years . . . so Mississippi Chemical Corporation replaced it with long-lasting, *stay-dry* FOAMGLAS. William B. Dunwoody, General Operations Manager at Mississippi's Yazoo City plant says:

"Moisture penetration and migration ruined the original organic insulation. We had to find a truly waterproof insulation to replace it. We picked FOAMGLAS because we know its sealed glass cells simply can't absorb or transmit moisture in any form.

"We reinsulated the 48 ft. diameter sphere in sections in order to keep it in continuous operation. As each section of failed insulation was removed, it was immediately replaced with FOAMGLAS. That meant that the new insulation had to be stored in the open nearby —and it rained nearly half the time the work was going on. Pouring rain never harmed the FOAMGLAS . . . proving to us that this remarkable insulation *is* completely waterproof. We're sure that it will give us long-lasting, dependable insulating performance without costly maintenance and repair," concludes Mr. Dunwoody.

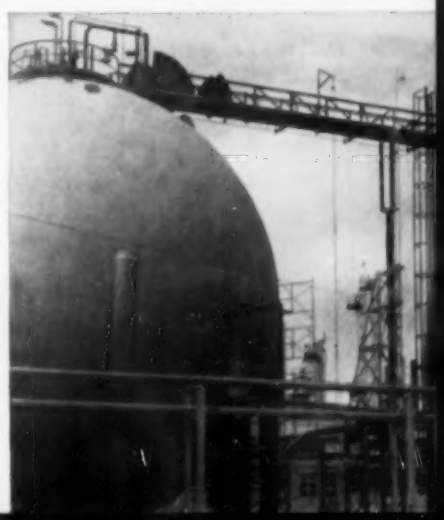
Let Mississippi Chemical's experience be *your* guide to constant, highly efficient insulating performance with *stay-dry* FOAMGLAS. This unique cellular glass insulation is completely inorganic, cannot rot or deteriorate. It is fireproof and acid-proof. It will give you the maintenance-free insulating performance you need for your piping, tanks, spheres and other industrial equipment. Why not send today for a sample and our detailed, descriptive literature.

Pittsburgh Corning Corporation

Dept. PP-95, One Gateway Center
Pittsburgh 22, Pennsylvania

In Canada: 57 Bloor St. W., Toronto, Ontario

Mississippi Chemical avoided a costly shutdown of this ammonia storage sphere by reinsulating it in sections. As each section of the old, watersoaked insulation was removed, it was immediately replaced by waterproof blocks of FOAMGLAS. Insulation Contractor was North Brothers, Birmingham, Alabama.



You can end valve operating difficulties in HIGH TEMPERATURE, HIGH PRESSURE and CORROSIVE SERVICES with . . .

ASSURE DEPENDABLE, TROUBLE-FREE CONTROL OF "HARD-TO-HOLD" FLUIDS

A positive mechanical means for (1) relieving seating pressure to permit easy operation, and (2) for pressing the tapered plug firmly into its seat to give drop-tight service, is built into every Homestead Lever-Seald Valve. All operating parts and seating surfaces are fully protected from the corrosive or erosive effect of line fluids.

That is why Lever-Seald Homestead Valves are noted for their extremely long continuous service, with a minimum of maintenance. They are available in semi-steel, steel, stainless, bronze, and other alloys suitable for the service conditions.

Mail the coupon today for full details.

Without obligation, please send me
VALVE REFERENCE BOOK No. 39-3
covering Homestead Lever-Seald Plug Valves.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

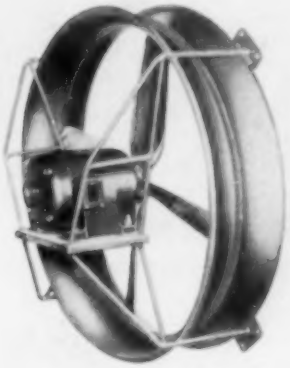
CITY _____ STATE _____

HOMESTEAD VALVE MANUFACTURING COMPANY
"Serving Since 1892"

P.O. Box 43 Coraopolis, Pa.

mum stem diameter is 0.365 in. to fit a standard ⅜-in. I.D. thermowell for use in extremely corrosive liquids or in tanks under very high pressures. The Detector without a thermowell will withstand pressures to 300 psi. Minimum stem length is 8 in. up to a maximum of 44 in. Thomas A. Edison, Inc., Instrument Div., West Orange, N. J.

Circle No. **67** *on Reply Card*



Reversible Fan

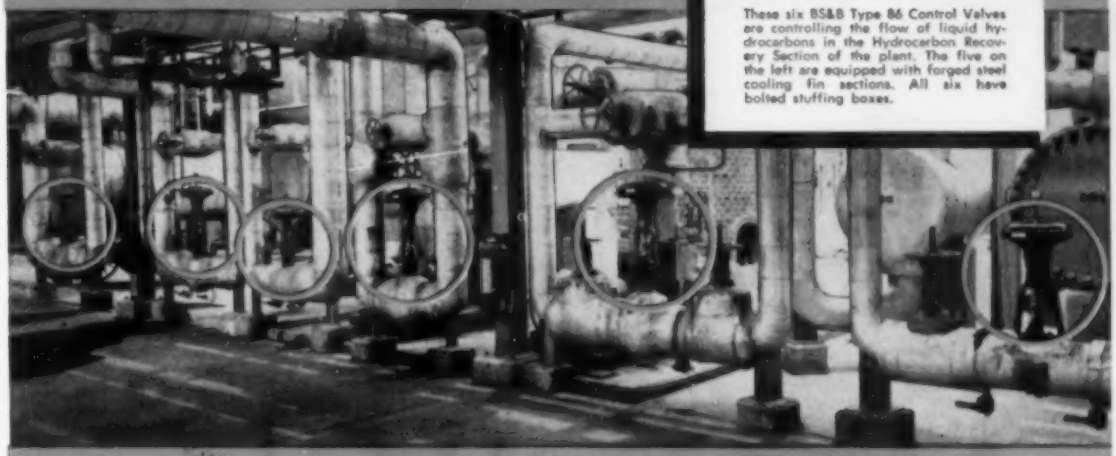
. . . **for industrial ventilation** equipment. The "Double Ring Reversible Fan" is designed for ventilating jobs requiring intake during some periods and exhaust during others. It consists of an aluminum alloy reversible propeller and two curved orifices welded face to face. The fan is available in direct connected, belt drive, pulley drive, and extension shaft models in 28, 36 and 44-in. diameters. Hartzell Propeller Fan Co., Piqua, Ohio.

Circle No. **68** *on Reply Card*

Multiple Outlet Headers

. . . **simplify installation** and reduce costs of by-passes, blow-downs and branch connections in pipeline gate settings. The basic outlet design close-

Where *Dependability* Counts Most...



These six BS&B Type 86 Control Valves are controlling the flow of liquid hydrocarbons in the Hydrocarbon Recovery Section of the plant. The five on the left are equipped with forged steel cooling fin sections. All six have bolted stuffing boxes.

BS&B Automatic Controls Get The Job!

One of the largest petro-chemical plants in the world is that of the National Petro-Chemicals Corporation at-Tuscola, Illinois. This $50,000,000 plant extracts the heavier hydrocarbons from natural gas and converts them into fuels and chemicals used in the manufacture of plastics, synthetic fibers, fertilizers, detergents and dozens of other useful products.

This plant is largely automatic, thanks in large measure to numerous BS&B Pressure Control Pilots and Liquid Level Control Pilots—and to *more than 200* BS&B Automatic Control Valves in plant service!

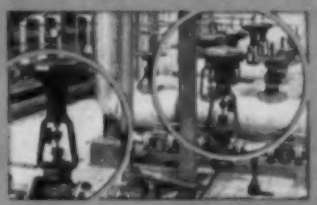
Valves range in size from ¾" to 8", many supplied with special body materials. Body types range from screwed globe cast iron valves to 600# ring type joint, flanged globe steel valves. Some were supplied with Haveg Bodies.

Valve trim included such materials as stainless steel and Hastelloy "B". Several valves in strategic plant locations were furnished with our Type Y Side Handwheels for emergency operation in the event of an operating medium failure. Some, destined for high temperature operation, were equipped with finned cooling sections. Many were furnished with valve positioners, either yoke mounted or mounted in the diaphragm case.

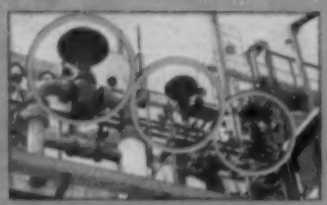
But however specialized the application, each BS&B Control was selected for the job because of its *dependability*...so vital to the successful operation of so complex a plant!

Next time you have a project in the planning stage, why not discuss the controls aspect of it in *strictest confidence* with our representative to be sure you get the *very best* controls for the job to be done?

For Better Regulation of Pressures, Temperatures, Liquid Levels or Flow, Equip Your Process With BS&B AUTOMATIC CONTROLS and SAFETY HEADS!

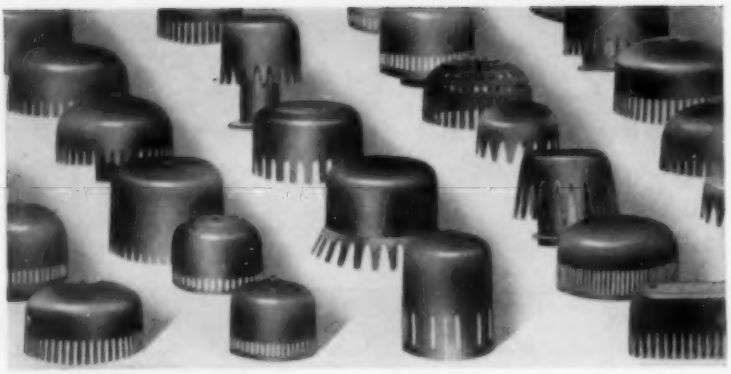


These six Type 86's, also with bolted stuffing boxes, are controlling the flow of fuel gas to the still heater in the Hydrocarbon Recovery Section of the plant.



These three BS&B Control Valves are on ethylene service in the Emulsive Section of the plant. On the left is a BS&B Type 75 DC Pressure Balanced Control Valve. In the center is a Type 86 with Finned Cooling Section and Jumbo Diaphragm. On the right is a Standard Type 86 with Large Topworks.

BLACK, SIVALLS & BRYSON, INC.
Controls Division, Dept. 4-D9
7500 East 12th Street
Kansas City 26, Missouri



SEND FOR PSC

BUBBLE CAP BULLETIN 22

Largest Compilation of Engineering Data.

Lists 300 Styles Furnished Without Die Cost.

This standard reference on bubble caps and risers contains complete specification information for hundreds of variations. Also many drawings for use in determining methods of tray assembly. With dies on hand for all listed styles, PSC can save you substantial die costs as well as design and delivery time. Furnished in any drawing type of metal, to meet your coking or corrosion problems. Assemblies will also be produced to your specifications.

THE PRESSED STEEL CO., 717 N. Penna. Ave., Wilkes-Barre, Pa.

PSC

Custom Fabricators for the Process Industries Since 1928. Send Your Blue Prints.

HIGH QUALITY

ANHYDROUS

Aluminum Chloride

PRODUCED IN TWO GRADES
RESUBLIMED & SUBLIMED

THE PUREST COMMERCIAL MATERIAL AVAILABLE

ANY PARTICLE SIZE OBTAINABLE

OUR STANDARD SIZES

POWDER (-20 MESH) GRANULAR (-4+20 MESH) LUMP (-1+4 MESH)

INFORMATION CONCERNING THE PREPARATION of AQUEOUS OR ALCOHOLIC SOLUTIONS OF $AlCl_3$ OBTAINABLE BY WRITING

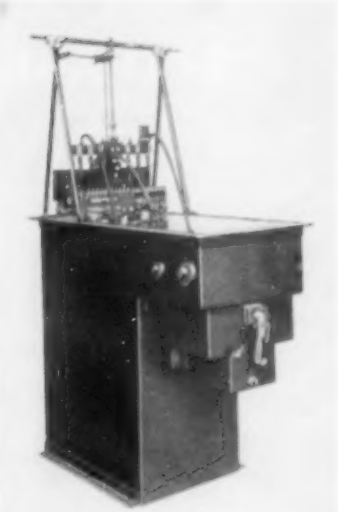
OHIO-APEX DIVISION

FOOD MACHINERY & CHEMICAL CORPORATION – NITRO, W. VA.

MANUFACTURERS & CERTIFICATES OHIO APEX fmc

ly parallels the integral outlet of seamless welding tees. Walls are formed from seamless pipe by a forging process which directions metal grain flow, improves metal structure, distributes metal for increased strength in crotch zones and reduces flow turbulence by providing smooth transition between header and branch. Installations have been made on 24 and 30-in. lines with one, two and three outlets per header ranging from 6 to 12 in. in diameter. The "Multiple Outlet Headers" are produced in sizes up through 42-in. pipe, and larger if required. There is little restriction as to length of header sections, number and sizes or arrangement of outlets, or range of conical reducer sizes. Ladish Co., Cudahy, Wisc.

Circle No. **69** *on Reply Card*



High Voltage Starters

. . . are for corrosive atmospheres. Originally designed for oil refinery use in Class I, Group D, Division 2 locations, they are equally applicable for corrosive services in the petrochemical industries. The starters are totally oil-immersed with contactors, relays and all electrical units under a large head of oil. The contactor, "ZHS Magnetic," has certified 50,000 kva interrupting capacity. All power and control leads are brought out of the oil through anti-syphon joints to a self-contained conduit connection box. The starter is supplied in combination style with a self-contained disconnect switch—Type III weatherproof—or without a disconnect switch for users preferring to furnish their own means

SHELL REPORTS

A PICTURE ROUND-UP OF SOME ACTIVITIES THAT MADE NEWS OUTSIDE THE PETROLEUM WORLD

CRYSTAL BALL. To "zero in" on off-shore drill sites with pin-point precision, Shell engineers came up with this spinning, mirrored marker. The "crystal ball" rotates atop a buoy in an off-shore exploration area. Ashore, surveyors on two eighty-foot towers spot the marker by its dancing reflections and "fix" the new drill site. Shell's efficient handling of such everyday problems means faster development of off-shore oil exploration — a vast new reserve for America to count on.

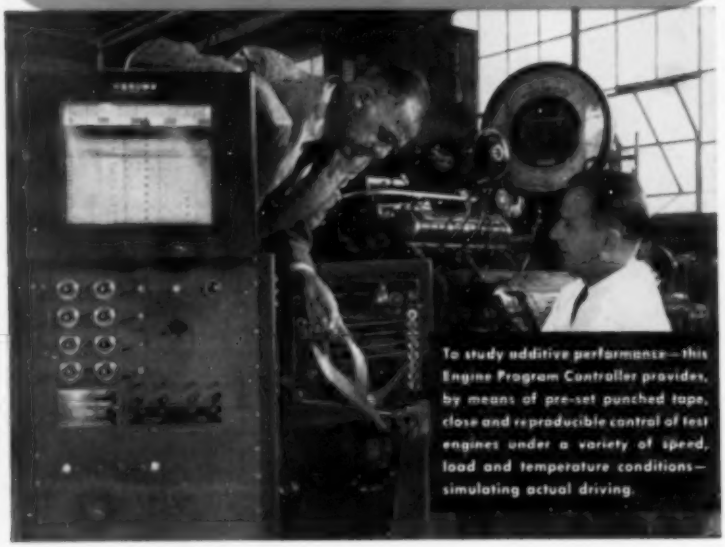
SAFETY IN NUMBERS. Safety at Shell is a full-time job. In this demonstration a .22-caliber bullet is fired into the safety lens of protective goggles. Even with a direct hit, the safety lens will not shatter! Recently, safety-conscious Shell people at the Wilmington-Dominguez Refinery, Calif., amassed a record of almost 4,000,000 man-hours without a lost-time accident. Records like this mean safer working conditions and lower cost, better quality products for everybody.

BUILD A HILL. A boy forever needs a hill to climb — and this designer in Oakland, Calif., is making one. Using a fabric impregnated with Shell's new EPON® resin, a strong, safe "mountain" is formed for active youngsters to climb up and over. This is only one of the many uses found — and yet to be found — for versatile Shell EPON resin. The potential of EPON resin is so great that each week Shell researchers are developing more and more useful and necessary products from it. Shell people work for new methods, new products, and new ideas for easier living.

SHELL

 (To obtain more data on advertised products see page 1472)

Ask about Oronite's "custom-formulation" of lube oil additives



To study additive performance—this Engine Program Controller provides, by means of pre-set punched tape, close and reproducible control of test engines under a variety of speed, load and temperature conditions—simulating actual driving.

Better oil performance at a competitive treating cost

Oronite specializes in "custom-formulating" additives to your exact needs—meeting your price and performance specifications. Because of Oronite's advanced research, testing and manufacturing facilities, custom-compounding has been accomplished at progressively lower treating costs.

With a years-ahead additive program it is possible that Oronite could provide your finished oil with competitive advantages you need to win and hold a market.

Why not talk it over with an Oronite additive specialist. Contact our office nearest you.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for 2-104-B, MIL-O-2104, Supplement 1 and Series 2 oils.

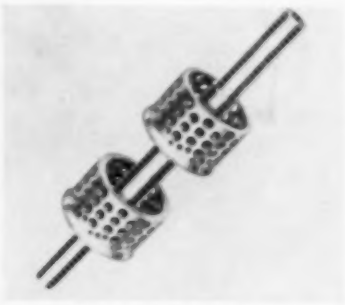
OTHER ORONITE PRODUCTS
Gas Odorants
Polybutenes
Phenol
Wetting Agents
Fuel Oil Additives

ORONITE CHEMICAL COMPANY
200 Bush Street, San Francisco 20, California
30 Rockefeller Plaza, New York 20, New York
20 North Wacker Drive, Chicago 6, Illinois
714 W. Olympic Blvd., Los Angeles 15, Calif.
Mercantile Securities Building, Dallas 1, Texas
Carew Tower, Cincinnati 2, Ohio

ORONITE CHEMICAL COMPANY

of disconnecting the motor and starter circuit from the power source. The Electric Controller & Mfg. Co., 4500 Lee Road, Cleveland 28, Ohio.

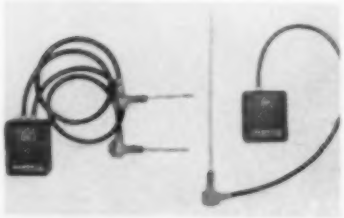
Circle No. **70** *on Reply Card*



Flash Flow Plug Valve

. . . **eliminates vibration and noise** often occurring in valves on flashing liquid service, as well as eliminating trim deterioration. In the "Flash-Flo Plug Valve," threaded holes are geometrically spaced around the plug skirt to create turbulence and distribute energy release over a large surface area. This converts potential energy directly to heat by means of internal turbulence of the liquid to leave less kinetic energy available for damage to the piping. The temperature rise of the metals is almost unnoticeable. The company's control valves are offered with the Flash-Flo Plugs in nominal sizes from 3 to 16 in., with either single or double seated construction. Materials and Plug flow characteristics are as per customer specifications. Hammel-Dahl Co., 175 Post Road, Providence 5, R. I.

Circle No. **71** *on Reply Card*



Electronic Controller

. . . **has three variations** for level and flow detection and control. The three models are called the "tube-in-probe Tektor," "differential Tektor," and the "time delay Tektor." The tube-in-probe Tektor is for controlling levels of substances with low electrical conductivity, or for interfaces of materials with similar dielectric constants, and is contained in an explosion-proof

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

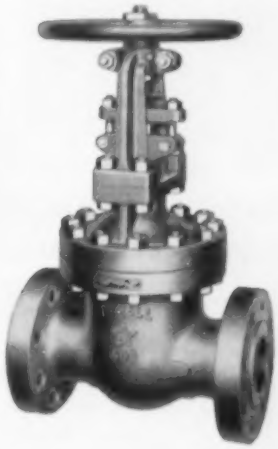
. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES FOR MODERN INDUSTRY

FIG. 2193—Ni-Resist* Gate Valve for 200 Pounds W.O.G.

FIG. 6061 SS—600 Pound Stainless Steel Swing Check Valve

FIG. 6003 SS—Alloy Steel Gate Valve for 600 Pounds W.S.P.



*Trademark of The International Nickel Co.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

When you think of valves—think of Powell. For Powell has a *complete* quality line. Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Shown above are just a few Powell Valves. Investigate these valves . . . *and* the *complete* line of quality valves made of bronze, iron, steel, special alloys and pure metals.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write . . .

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year

BURRELL "For Scientists Everywhere"

presents THE FRACTON®

A New Instrument For Analysis of Light Hydrocarbons

2 to 3 Times Faster!

For:

NATURAL GAS

GASOLINE PLANT GASES AND LIQUIDS

REFINERY GASES

CYCLING PLANT GASES

LIQUEFIED PETROLEUM GASES

SYNTHETIC RUBBER INTERMEDIATES

PLASTIC INTERMEDIATES

PETROCHEMICAL GASES

and other light hydrocarbons

THE FRACTON CUTS ANALYSIS TIME AND EXPENSE, IMPROVES ACCURACY AND IS EASIER TO OPERATE

Request your Copy of FRACTON BOOKLET No. 82

The Fracton separates, identifies, collects and measures the components and records the analytical data in fifty to seventy-five percent less time than former methods. Users get superior accuracy and reproducibility with this new improved and simplified instrument.

® TRADEMARK

BURRELL CORPORATION

2223 FIFTH AVENUE, PITTSBURGH 19, PENNSYLVANIA

Manufacturers and Distributors of
SCIENTIFIC APPARATUS and LABORATORY CHEMICALS

housing. The differential—shown in the photograph above—Tektor allows control of the high-low differential level for spans of approximately five feet with a single instrument in applications where the cycle of rising and falling is completed continuously. The time delay Tektor controls material flows to be delivered in clumps, waves or generally erratically, and avoids the convulsive start and stop performance of control pumps, motors and valves, as well as eliminating relay chatter. Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia 33, Pa.

Circle No. **72** *on Reply Card*

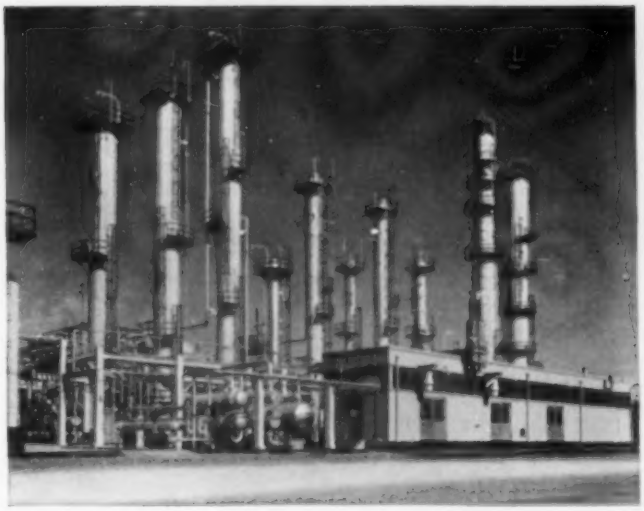
Single-Wrap Pipe Tape

. . . offers double-wrap protection with only a ½-in. overlap. This coal tar tape, called "Tapecoat-X," can be used not only for pipe, but for joints, fittings and couplings. Features claimed include ease of application through a separator-film which facilitates unrolling the tape, and automatically disappears in the application process; faster wrapping; and overall savings in material costs. The tape is available in rolls with 2, 3, 4 and 6-in. widths. Tapecoat Co., 1523 Lyons St., Evanston, Ill.

Circle No. **73** *on Reply Card*

Vacuum Pump Oil

. . . used in diffusion pumps to enable the attainment of high vacuum without the use of traps or involving liquid air or charcoal. The oil, "Bevins 8," is chemically and thermally stable within limits imposed by high-vacuum pump operation. The oil is purified di-ethyl hexylphthalate with a boiling point of 126°C. at 0.01 mm Hg and 180°C. at 0.5 mm Hg. The specific gravity is 0.985 at 20°C. and the molecular



PARTNERS IN PETROCHEMICAL PROGRESS

It's a long road from the drafting board to the on-stream operation of a petrochemical plant, but it's a road which Procon has traveled successfully many times.

Outstanding among Procon's achievements in the petrochemical field are its installations of Udex extraction facilities for the production of high purity benzene, toluene, and xylenes. The quantity of these valuable aromatic hydrocarbons produced in Procon-built plants fills a substantial part of the industry's requirements.

As a construction organization, Procon will continue in its partnership with progress in petrochemicals . . . petroleum . . . and chemicals. It's a partnership for success.

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS

PROCON (CANADA) LIMITED—40 ADVANCE ROAD, TORONTO 16

PROCON (GREAT BRITAIN) LIMITED—112 STRAND, LONDON, W. C. 2

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

PROCON ®

TULSA TYPE

HOW TO FEEL YOUNG AT 40

FLINT STEEL CORPORATION is a 40-year old firm, but we're still youthful in our outlook and ability to get things done. We retain our youth by keeping up with all the latest developments in steel plate fabricating with modern equipment. And, we've been fabricating specialized TULSA TYPE equipment for the petroleum and petrochemical industries for 30 years. This combination of long experience and modern machines goes to work for you whenever you call on FLINT STEEL. We earnestly invite you to discuss your plate fabricating problems with us at any time.

Write for our General Catalog

BUILT Right

FLINT STEEL CORPORATION
TULSA, OKLAHOMA

Are You Moving?

Please let us know as soon as you can so we can change your subscription stencil addressing plate. Be sure to send us

(1) Your *old* address (including company connection)

(2) Your *new* address (including company connection)

(3) The *date* the change becomes effective

PETROLEUM PROCESSING—Subscription Department
330 West 42nd Street—New York 36, N. Y.

weight 390.2. Ultimate vacuum (guaranteed) is 2×10^{-7} mm Hg. at 25°C. in a three-stage fractionating pump, and the vacuum produced with a single stage, non-fractionating diffusion pump is 7×10^{-6} mm Hg. at 25°C. without liquid air or charcoal traps. The oil pour point is minus 69°F. and the flash point 380°F. A. Daigger & Co., 159 West Kinzie St., Chicago 10, Ill.

Circle No. **74** *on Reply Card*

Liquid Level Control

. . . **works by buoyancy** obtained by displacement of a solid immersed in a liquid to control liquid level in high pressure service. A solid block displacer of glazed porcelain or Karbate loads its weight on a compression support spring. Raising liquid level imparts buoyancy to the displacer in proportion to the weight of the liquid it displaces to unload the spring and upon further rise, to produce the desired switch action. Conversely falling liquid level subtracts buoyancy to cause low level switch action. Models are available for services at pressures up to 1500, 3000 and 5000 psi. The control is designed to operate with liquids with specific gravities of 0.40 or greater. The Inconel compression spring is for temperatures up to 300° F. Magnetrol, Inc., Chicago, Ill.

Circle No. **75** *on Reply Card*

Free Trade Literature

Automatic Programming

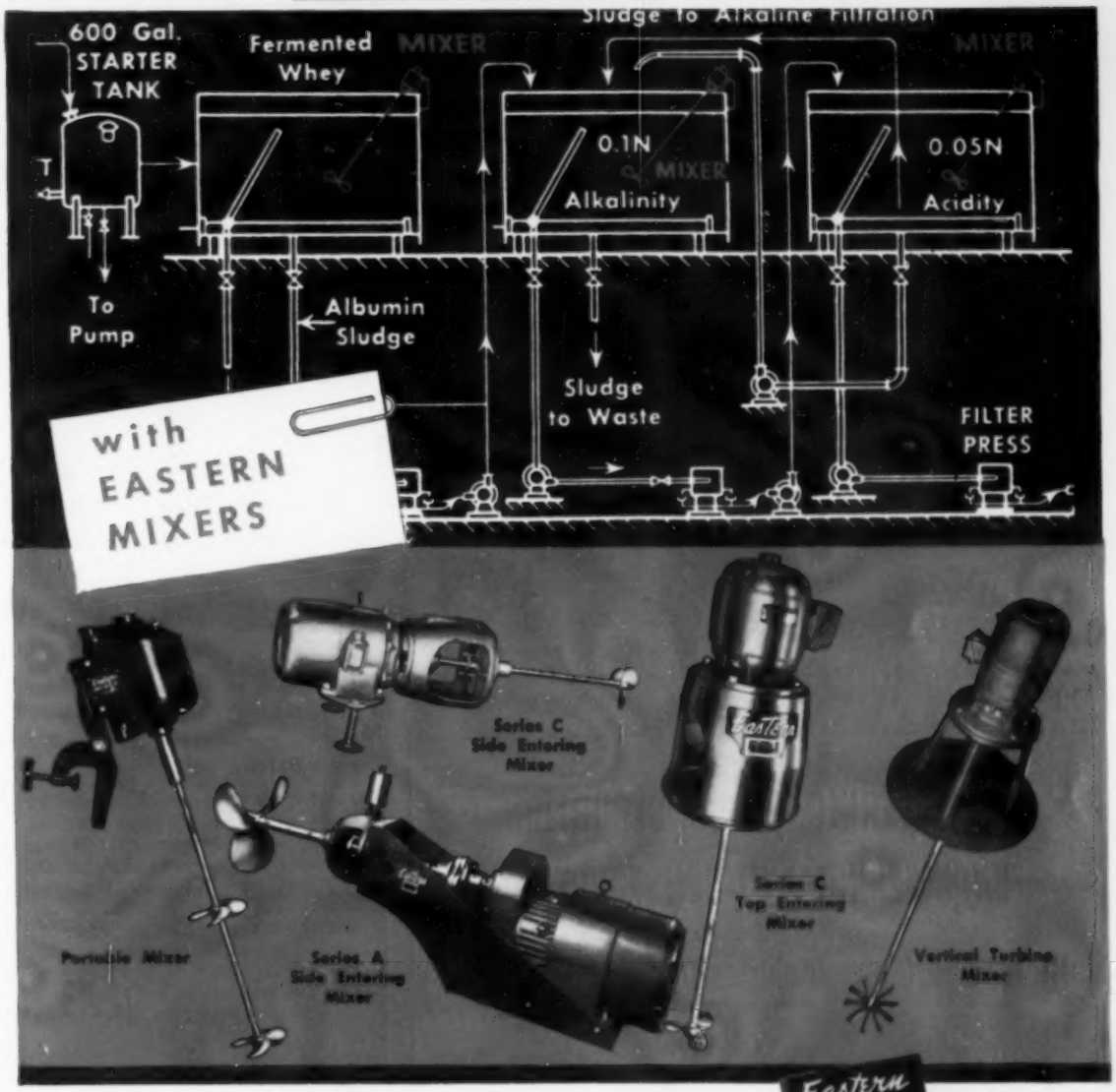
. . . to make the computer do much of the actual work of instructing itself, thus reducing the time-consuming task of coding, writing and checking instruction programs for computer operations: bulletin *Automatic Programming Turns Months Into Minutes* describes the concept of programming and automatic programming for electronic computers. Remington-Rand, Div. of Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

Circle No. **01** *on reply card*

Liquid Meters

. . . for industrial applications: *Catalog No. 36* covers the single-piston meter for volumetric measurement of practically all liquids, and featuring the new explosion-proof "Electicontact" registers, latest refinements in chemical meters and complete in-

RELIABLE FLUID MIXING in PROCESSING



Eastern's Mixers are designed to meet the needs of today's chemical and industrial processes. Many types are available to satisfy all conditions of fluid consistencies and tank sizes. Selection may be made from a wide range of horsepower, speed, and construction materials. Motors with various voltage ratings and enclosures are also furnished.

PORTABLE MIXERS

Series H at 1725 R.P.M., Series S at 1125 R.P.M., and Series G at 420 R.P.M. are available in motor ratings from 1/20 to 5 H.P. Also available are special speeds, variable speeds, as well as air driven models.

TOP AND SIDE ENTERING

Series A, extra heavy duty for large tanks, are available in side entering units only within a range of 5-30 H.P. with standard speeds of 280, 420, and 1150 R.P.M.

Series C, for average tank capacities, are available in sizes of ¼ to 10 H.P. at these standard speeds: 1725 R.P.M. (up to 5 H.P.); 1140 R.P.M. (up to 10 H.P.); 420 R.P.M. (up to 7½ H.P.); 280 R.P.M. (up to 5 H.P.). Available in both horizontal and vertical models.

TURBINE MIXERS

Eastern's Top and Bottom Entering Turbine Mixers find particular application where liquid blending requires gentle, yet thorough agitation.

Models are available in sizes from ¼ to 40 H.P. Standard speeds are 56, 68, 84, 100, 125, 155 R.P.M.

For 3 bulletins covering Eastern Mixers, request Catalog Series 29.

Eastern INDUSTRIES, INC.
Mixer Division
Regent St., Norwalk, Conn.

FROM YOUR BASIC FLOW DIAGRAMS— A FINISHED PLANT QUICKLY, ECONOMICALLY

A plant designed for *your* needs based on *your* process flow diagrams—this is the service we offer petroleum refiners. Each Kuljian project is unique because it is designed . . . and built . . . with just one objective in mind—the maximum return on your investment at the earliest possible date.

ENGINEERING OR CONSTRUCTION
ENGINEERING AND CONSTRUCTION

Kuljian Experience Includes:

Refinery Facilities In General
Process Systems & Instrumentation
Fuel Storage Systems & Piping
Steam Generation & Utilization
Electrical Generation & Distribution

The Kuljian Corporation
engineers • constructors
1200 North Broad Street • Philadelphia 21, Penna.

BRANCH OFFICES THROUGHOUT THE WORLD

formation on standard lines of meters for non-corrosive liquids. Send request for information on company letterhead to Buffalo Meter Co., 2917 Main St., Buffalo 14, N.Y.

Circle No. **02** *on Reply Card*

Low-Cost Computer

. . . for scientific computation, data processing, records keeping, data reduction, and industrial control: 12-page brochure *Readix* discusses the operation of the equipment including input devices, output devices, auxiliary data storage, programming, construction, and explanation of commands. A. B. Rea Co., Inc., 1723 Cloverfield Blvd., Santa Monica, Calif.

Circle No. **03** *on Reply Card*

Solenoid Valves

. . . for use where prevention of product contamination is important: *Catalogue No. 101* gives facts and features of the "Valcor" valve, model numbers, size numbers, maximum operating pressures, and a price list. Valcor Engrg. Corp., Carnegie Ave., Kenilworth, N. J.

Circle No. **04** *on Reply Card*

Fire Bricks

. . . for use in industrial furnaces for steam generators, chemical processes, and petroleum furnaces, etc.: 28-page *Bulletin R-34* discusses and graphically illustrates typical furnace fire brick applications, and gives tables for estimating brick quantities for arches and circular lining. Refractories Div., The Babcock & Wilcox Co., 161 E. 42nd St., New York 17, N. Y.

Circle No. **05** *on Reply Card*

Packaged Steam Generators

. . . with capacities from 10,000 to 46,000 lb. steam per hour: 16-page catalogue on *Packaged Steam Generators* gives capacities, dimensions, construction features, instrumentation accessories, sectional drawings, installation photographs, and a chart for selection of firing equipment and controls. Foster Wheeler Corp., 165 Broadway, New York 6, N. Y.

Circle No. **06** *on Reply Card*

Plunger Pumps

. . . with 2-in., 4-in., 5-in. and 6-in. strokes for use in the petroleum industry and other industrial process pumping applications: 11-page *Bul-*

TO MAINTAIN HIGH PRODUCTION

AND REDUCE DOWN-TIME...

ESSO installs 7,956 Anaconda Cupro Nickel, 30%-702 Tubes in condensers and coolers at Bayway Refinery

This condenser is used in the No. 1 Fluid Catalytic Cracking Unit at the Bayway Refinery of Esso Standard Oil Company at Linden, N. J. The unit produces about 25,000 barrels of petroleum products daily—ranging from high octane gasoline to heating oils.

7,956 ¾" Cupro Nickel, 30%-702 Tubes were supplied by Anaconda for the condensers and coolers of this cracking unit. On the shell side, these tubes are subjected to temperatures as high as 550°F at 75 PSI by process streams containing both sulfur and salt compounds. On the tube side, the summer salt water temperature ranges from 80°F at the inlet to 110°F at the outlet.

Information gathered from test runs within the refinery indicates these ANACONDA Cupro Nickel, 30%-702 Tubes have a life expectancy in this service of from 6 to 12 times greater than tubes made of Admiralty Alloy.

ANACONDA Cupro Nickel, 30%-702 Tubes are recommended where process liquids, vapors and cooling waters are corrosive—particularly where temperatures are too high for other copper alloys. Tubes of this alloy also have superior resistance to sea water at high velocities. They have good physical properties at elevated temperatures and resist stress-corrosion cracking.

Our files bulge with a collection of tube performance case histories that can answer many of the corrosion problems you face. We can put the information in these files to work for you at once—to help you select the one best alloy for your job. Write, outlining your operating conditions, to Dept. TD, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Ont. 84111

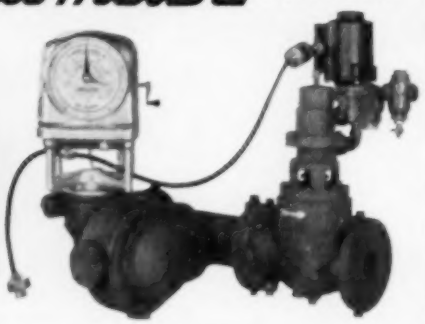
ANACONDA®

Tubes and Plates for Condensers and Heat Exchangers

(To obtain more data on advertised products see page 1472)

THE *Fluidometer* SYSTEM

for the automatic batching of light or heavy liquids



Adaptable to a wide variety of measuring problems

The Fluidometer System provides an accurate, dependable, and completely automatic method for batching liquids, either light or heavy. It is available in either jacketed or unjacketed construction, and is adaptable to practically any liquid measuring problem, whether it involves gallons, barrels or tank car lots. Equally accurate on liquids of high or low viscosity. Anything that can be handled through a meter can be accurately batched by the Fluidometer. The automatic reset, an exclusive feature of Fluidometer, is invaluable in large scale production work requiring steady repetition of operations.

Bulletin Fl-49, giving complete information on the Fluidometer System, will be sent on request.

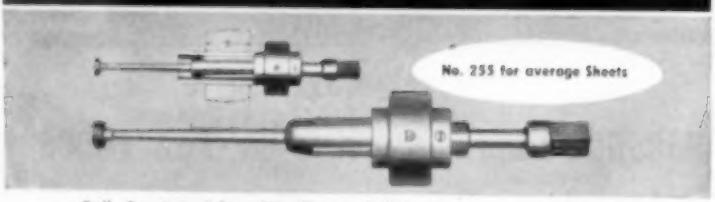
H&B ESTABLISHED 1887

HETHERINGTON & BERNER INC.

715 KENTUCKY AVE. INDIANAPOLIS 7, IND.

IDEAL

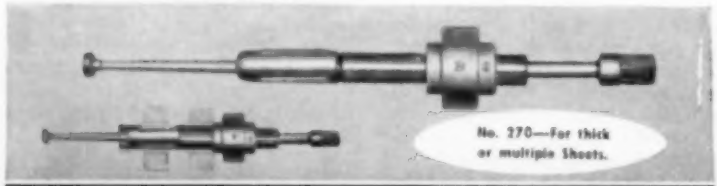
WIEDEKE Precision-Built Tube Expanders



Ball Bearing Adjustable Thrust Collar Tube Expanders are made for Tubes ¼" diameter and larger.
Recommended for use with any Controlled Rolling Motor for uniform expansion of Tubes.

See your Dealer or write us for Bulletin.

For Rolling—Heat Exchanger, Condenser and other Heat-Transfer Tubes.



THE GUSTAV **WIEDEKE** COMPANY
DAYTON 1, OHIO

letin No. W-414-B45A explains the major pump features, gives a rating chart list for the various pump types with data on size, speed, displacement, discharge pressures, etc. Worthington Corp., Advertising and Sales Promotion Dept., Harrison, N. J.

Circle No. **O7** *on Reply Card*

Accident Prevention Aids

. . . available from the National Safety Council: 68-page *Service Guide 2.1* lists periodicals, newsletters, a complete library of technical and administrative publications, training films and several hundred made-to-order 5-minute safety talks covering all phases of occupational accident prevention. National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Circle No. **O8** *on Reply Card*

Plug Valves

. . . for 200 psig oil-water-gas, or 150 psig steam working pressure: 27-page *Reference Book 39—Section 5* describes the valve and its features, lists the available models with dimensions, as well as valves, wrenches, locking devices, extensions, and floor spans. Valve Div., Homestead Valve Mfg. Co., Corapolis, Pa.

Circle No. **O9** *on Reply Card*

Steel Dictionary

. . . of terms of particular value to those using cold finished steel bars: 32-page *Helpful Data Bulletin No. 6*, entitled "Simplified Steel Terms and Engineering Data," includes more than 180 detailed definitions frequently used in the purchase, manufacture, treating, machining and finishing of steel. LaSalle Steel Co., Chicago 80, Ill.

Circle No. **P1** *on Reply Card*

Screening Equipment

. . . applicable for more than 241 different materials including chemicals, petroleum, metals, rubber, waste and pollution control: 20-page *Catalogue 112-318* describes the various models of "Sweco" separators and the industries they serve. Southwestern Engineering Co., 4800 S. Santa Fe, Los Angeles 58, Calif.

Circle No. **P2** *on Reply Card*

Plastic Tank Lining

. . . for plating tanks, racks, vats, etc. handling various acids, caustics and oxidants as well as many organics: bulletin on "Koroseal Lining" stresses application to protect metallic surfaces from corrosion, gives advantages,

MAINTENANCE? *what's that?*

With YARWAY Impulse Steam Traps, what little maintenance there is can be handled in a jiffy. There's only one moving part—a tiny valve.

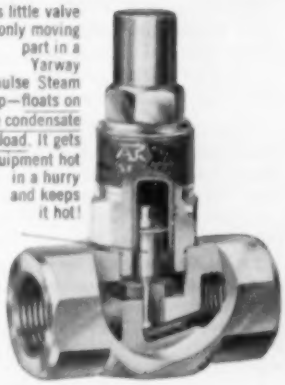
When the trap must be cleaned or repaired, it can be done right in the line—in a matter of minutes.

Other YARWAY features:

- **Stainless steel—body and internal parts.**
- **Gets equipment hot in a hurry—and keeps it hot.**
- **Good for all pressures without change of valve or seat.**
- **Easy installation—small size, light weight.**
- **Non-freezing at low temperatures.**
- **Six standard sizes, ½" to 2".**

Want proof of performance? Try a YARWAY Impulse Trap and Fine Screen Strainer FREE for 90 days in your own plant. For free trial or free catalog, write . . .

YARNALL-WARING COMPANY, 153 Mermaid Ave., Philadelphia 18, Pa.



This little valve—only moving part in a Yarway Impulse Steam Trap—floats on the condensate load. It gets equipment hot in a hurry and keeps it hot!

YARWAY impulse steam trap

OVER 1,000,000 YARWAY IMPULSE TRAPS SOLD—STOCKED BY 270 CONVENIENT INDUSTRIAL DISTRIBUTORS

limitations, their stability and a table of concentration limits of various chemicals to which Koroseal tank lining is corrosion-resistant. Metalweld, Inc., Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.

Circle No. **P3** *on reply card*

Plug Valve Lubes

. . . for the process industries: 16-page *Lube Manual No. 3* describes the forms of lubricants, service recommendations, valve lubrication, lubricating equipment, and ordering lubricants. ACF Industries, Inc., 30 Church St., New York 8, N. Y.

Circle No. **P4** *on reply card*

Furfural Data

. . . for physical properties, recovery from various systems and vapor pressures are given in 14-page *Bulletin No. 203-A*. Chemicals Dept., The Quaker Oats Co., Merchandise Mart, Chicago 54, Ill.

Circle No. **P5** *on reply card*

Bulk Liquid Storage

. . . services in the New York Harbor area or on the Gulf Coast: 14-page brochure *You Can Depend on Hess* describes contract storage for the

J-M BLAZECRETE
speeds refractory repairs...

That's why it pays you to use this hydraulic setting refractory for temperatures to 3000F

REPAIR old refractory linings—or build new ones—quickly and economically with Blazecrete*. For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place.

When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete goes on fast . . . without laborious ramming or tamping. *And Blazecrete linings last.*

Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix . . . can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Whether you gun it... *or slap-trowel it...*

Johns-Manville BLAZECRETE
BUILDS BETTER REFRACTORY LININGS

BARRETT automatic
Filling and Crimping Equipment
for handling greases and other viscous fluids.
- No operator required.
- 100% air operated.

Fills, seals, stamps and counts lug cover pails. Output of 15 pails per minute. Write for details on installation to meet your requirements.

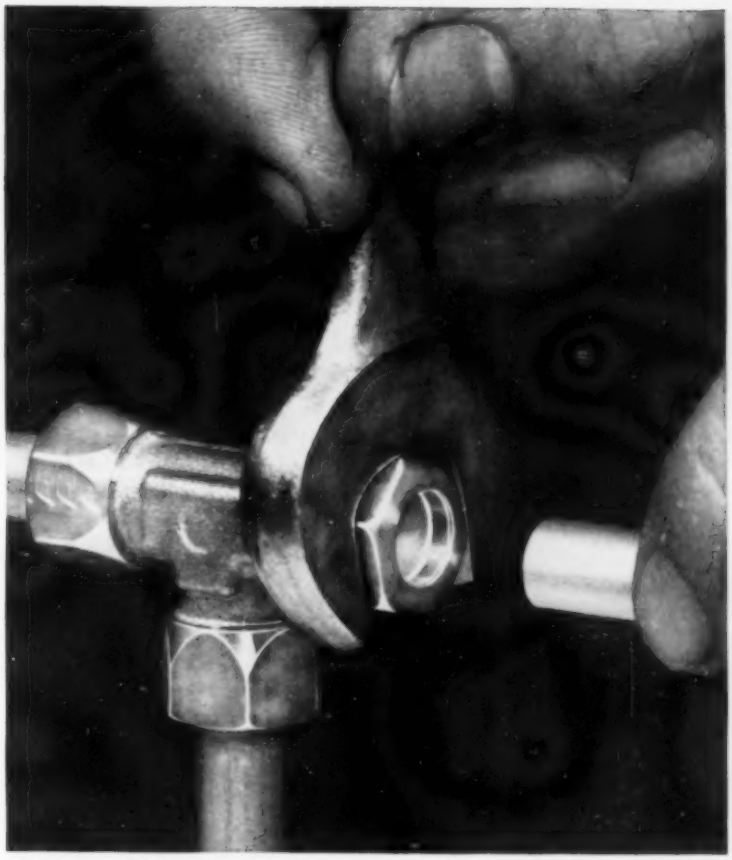
BARRETT
Manufacturing Co.
P. O. Box 8096, Houston 4, Texas

4330

for ACID-PROOF TANKS
SAUEREISEN ACID PROOF CEMENTS

Years of dependable service in leading steel mills, chemical plants, etc. A type for every acid proofing use.
Trial Order 10 lb. lot $3.30

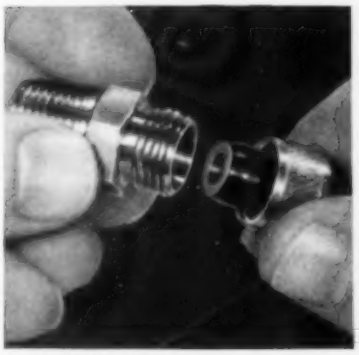
Sauereisen Cements Company · Pittsburgh 15, Pa.



Introducing easy-to-use PARKER INTRU-LOK tube fittings for instrumentation lines of ¼" through 1" O.D.

Simply push, then tighten! Anyone can quickly install all-new, *lightweight Intru-lok* tube fittings . . . the proven Parker 3-piece flareless design. Just insert the tube, then tighten the nut with a regular wrench . . . for a leakproof, vibration-proof joint. Made of brass for copper or nylon tubing. Mail the coupon for complete details in Catalog 4324.

TUBE AND HOSE FITTINGS DIVISION
The Parker Appliance Company
17325 Euclid Ave., Cleveland 12, Ohio



For soft plastic tubing you use knurled nut and expander insert with new *Intru-lok* body. Joints can be disconnected and reassembled. Complete details in Catalog 4324. Send for it.

Weld-lok fittings, for extreme temperatures, corrosion conditions . . . machined from high-quality steel or stainless bar stock and forgings . . . for tubing ¼" through 2" O.D.

TUBE AND HOSE
FITTINGS DIVISION
Section 413-S
The Parker Appliance Co.
17325 Euclid Avenue
Cleveland 12, Ohio

☐ Send new Parker *Intru-lok* Catalog 4324

☐ Also, *Weld-lok* Catalog 4370

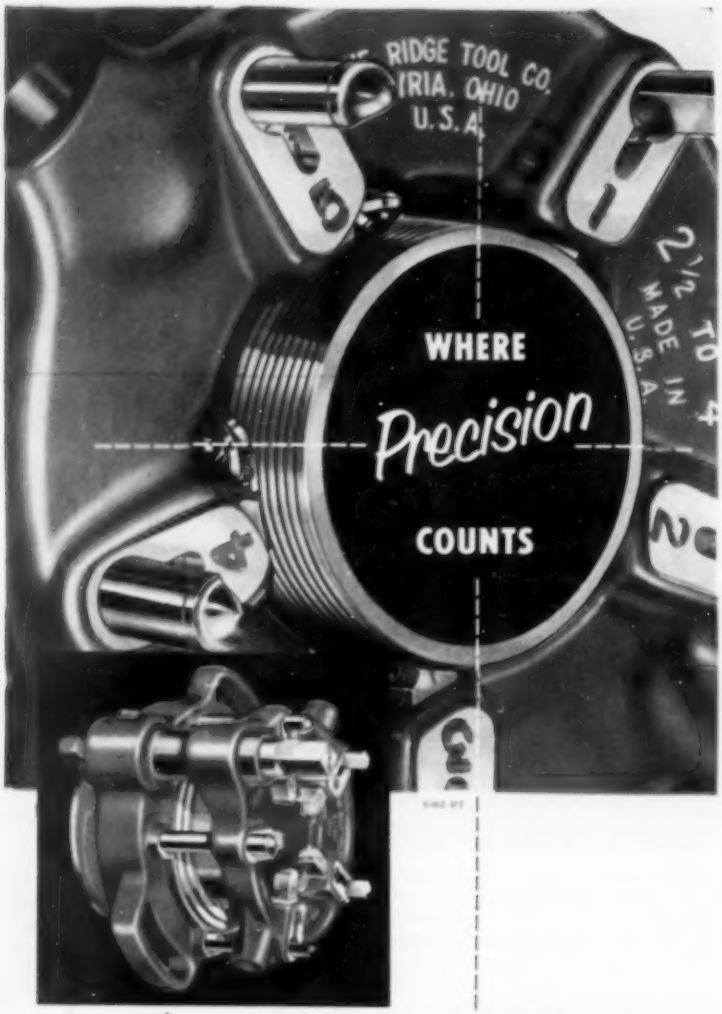
Name _____ Title _____

Company _____

Address _____

City _____ State _____

Parker
Hydraulic and fluid system components



...use the RIDGID 4P

2½" TO 4" GEARED PIPE THREADER

Here's a work-saving precision tool that cuts accurate threads on 2½" to 4" pipe *every time*. It's easy to handle . . . easy to use . . . foolproof.

Operated manually or with power, the RIDGID 4P reduces time, sweat and scrap in any piping job. Balanced handles simplify carrying and starting on pipe. Mistake-proof workholder sets to size *before* tool is put on pipe . . . has only one screw to tighten . . . no bushings.

For precision and speed . . . you can't beat the RIDGID 4P!

See your local supplier . . . or write direct for catalog.

RIDGID
WORK-SAVER PIPE TOOLS

MANUFACTURED BY THE RIDGE TOOL CO. • 536 CLARK STREET • ELYRIA, OHIO

petroleum, petrochemical, chemical and food industries, pipeline privacy, laboratory control, etc. Hess, Inc., Perth Amboy, N. J.

Circle No. **P6** *on Reply Card*

Liquid Meters

. . . for use with high vapor pressure, volatile materials such as propane, liquid anhydrous ammonia, and liquid oxygen: *Bulletin No. OG 407* describes the various types of meters available for different services. Meter & Valve Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Do Not Use Reply Card

Did You Miss These?

The following items, reviewed originally in June, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

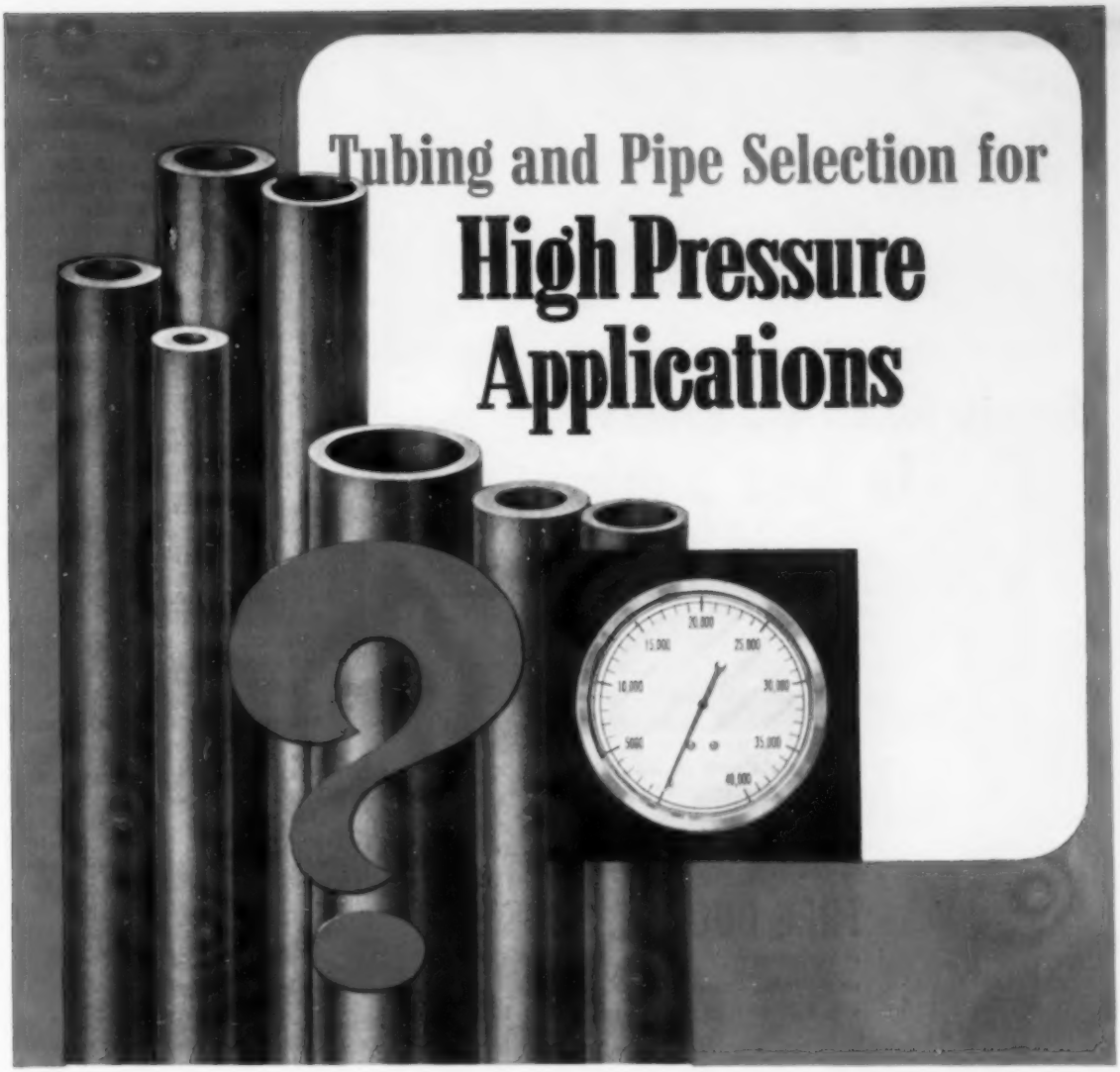
Pipe Line Sampler

. . . **operates automatically** and is designed to extract accurate line samples of crude oil, fuel oil, gasoline and most other liquids. The "Gilbarco Sampler" can extract as many as 300 small samples per minute to give representative composite samples, and can be supplied with control proportional to either time or flow. Pressures to 350 psi. and temperatures to 200° F. can be handled by standard models, with up to 350° F. and higher pressures in special models. The sampler has no motor or mechanical switches but is a small, low-capacity piston pump, magnetically operated from 20 to 300 cycles a minute. Stainless steel and other resistant materials are used, and the entire assembly is explosion-proof. The sampler can handle a wide range of viscosities, and is not affected by changes in liquid viscosity or gravity. Gilbert & Barker Mfg. Co., West Springfield, Mass.

Circle No. **76** *on Reply Card*

Centrifugal Action Mixer

. . . **is now available** which operates on the principle of a centrifugal pump. The "Rheinhuette" (German) mixer operates with a special impeller which



Specific working pressure is one of the major considerations in the choice of tubing or pipe for a given fluid-handling application. To obtain optimum efficiency and economy, however, it is necessary to consider temperature conditions, tube size, mechanical strength of the steel, and corrosion hazards.

A case in point that clearly shows the complexity of selecting the right tubing for pressure applications involved the installation of a stabilized stainless steel to carry methanol and unreacted synthesis gases at 300 F and 5000 psi while being exposed to chloride-bearing bayou water. This exposure caused pitting corrosion which, in turn, localized the pressure stresses at the roots of the pits causing, eventually, failure by stress corrosion. To effectively solve this costly problem, B&W with its long experience in all phases of tubing applications, helped in selection of B&W Croloy 5. This choice provided increased resistance to the pitting while meeting the temperature and pressure factors satisfactorily *and at a substantial savings in material cost.*

It takes an expert to specify the optimum tubing or pipe for any particular application. And there is no substitute for the kind of experience with such problems that you will find at B&W. To get the most benefit from B&W's long experience in matching tubes and piping to jobs—call on Mr. Tubes, your nearby B&W Tube Representative. *Or write for Bulletin 6.*

B&W
TUBULAR PRODUCTS DIVISION

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
General Offices, Beaver Falls, Pennsylvania
Plants and Products
Beaver Falls, Pa.—Seamless Tubing, Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing
Milwaukee, Wis.—Seamless Tubing, Welded Stainless Steel Tubing, Seamless Welding Fittings

TA-5058-P

 (To obtain more data on advertised products see page 1472)

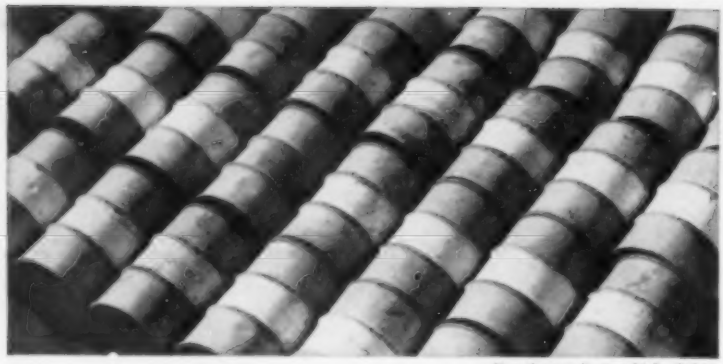


Photo Courtesy Standard Oil Co. (N.J.)

How to renew old drums
in just 7 minutes

THAT'S right! Used drums restored to like-new condition . . . cleaned, paint-stripped, rinsed, dried, and repainted—in just 7 minutes! That's how fast Oakite cleaning works in one barrel-house.

Reconditioning barrels and drums the Oakite way has these extra advantages: Fewer rejects . . . more uniform paint stripping . . . better adhesion for new paint. Elimination of paint build-up on steam coils . . . no clogging of drains and sewers.

Your Oakite Petroleum Service Representative will gladly help you get better, faster drum-conditioning. Call him today.

FREE BOOKLET F7629R tells all about drum-conditioning—tells how to save time and money on other big cleaning jobs. Write Oakite Products, Inc., 50D Rector St., New York 6, N. Y.

PETROLEUM SERVICE DIVISION

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U.S. & Canada

"Vaporization Equalibrium Constants And Activity Coefficient Charts"

You can still get a copy of this popular reprint—41 working scale charts (21 equilibrium constant charts for the hydrocarbons from methane to 700°F. boiling point, and 20 activity coefficient charts), plus a description of how to use them. 48 pages, 8½ x 11, paper bound (1949) $1.50

Address Reader's Service Department
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N. Y.

Note: New York City residents add 3% Sales Tax.

is rotated rapidly so that liquid is sucked from both top and bottom of the impeller and driven out radially at different velocities toward the sides.

The mixing impeller is roughly an oval block with one circular opening at the top and another on the bottom, each connected by curved channels to slots on the sides. During rotation, centrifugal force drives liquid radially through the slots—liquid then flows into the openings at top and bottom of the impeller to replace the liquid driven out. As the impeller rotates more rapidly, the suction at the top and bottom increases so that heavy liquids or solids are drawn from the bottom of the mixing container and lighter liquids are drawn down from the top.

The Rheinhuette mixer is recommended for liquid-gas, liquid-solid, miscible and immiscible liquids, and other difficult mixing jobs. U. S. representative for the mixer is Neumann & Weaver, Inc., 22-12 Raphael St., Fair Lawn, N. J.

Circle No. **77** *on Reply Card*

Compressed Air Handbook

. . . written to aid in measuring effective air compressor capacity: *Bulletin No. 520-A* gives hook-up sketches and design tips so as to improve compressor installation capacities and includes a pipe size-air flow rate-gage pressure-pressure drop chart. Sarco Co., Inc., Empire State Bldg., New York 1, N. Y.

Circle No. **78** *on Reply Card*

Corrosion Manual

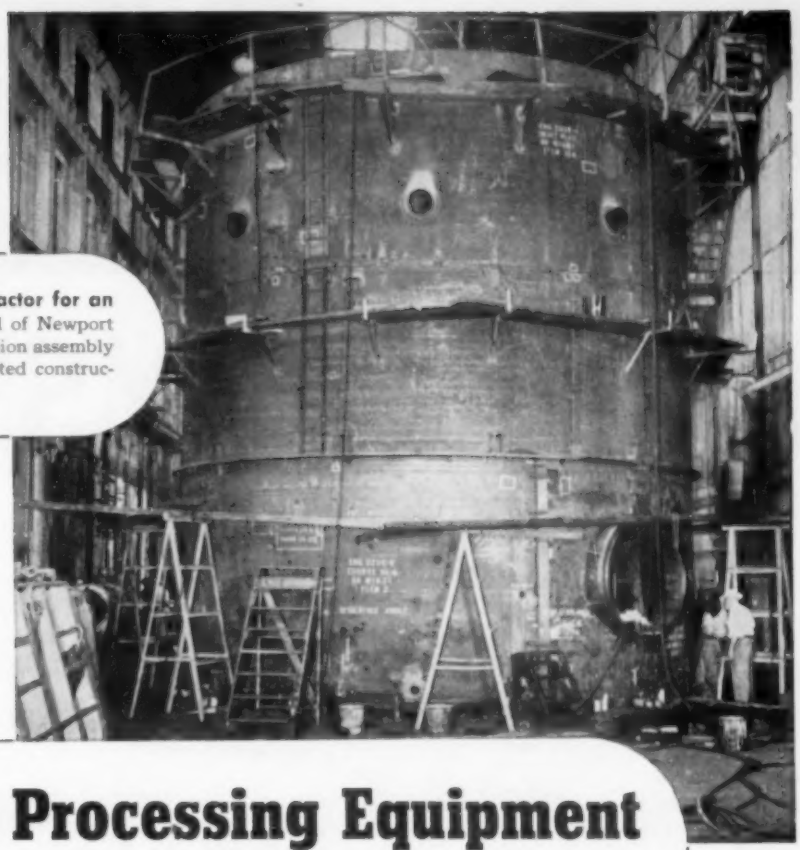
. . . gives methods of equipment and structure protection by use of special cements, bricks and plastic coatings; 23-page *Corrosion Engineers Manual* discusses different materials for special applications; gives construction basics, physical properties and corrosion resistance of protective materials; and tips and facts on tank and floor construction. Nukem Products Corp., 111 Colgate Ave., Buffalo 20, N. Y.

Circle No. **79** *on Reply Card*

Pump Trouble Chart

. . . designed to quickly identify the probable source of failure or erratic performance in the most widely used types of rotary displacement pumps: *Pump Chart Spots the Trouble* details over 25 possible mechanical and chemical trouble symptoms such as noisy and intermittent operation, rapid wear, leakage, seizure, foaming, etc. Eco Engineering Co., 12 New York Ave., Newark 1, N. J.

Circle No. **80** *on Reply Card*



Course number four of a reactor for an overseas oil refinery. Typical of Newport News plant methods, the precision assembly of this unit in the shop expedited construction of the reactor in the field.

Petroleum Processing Equipment

...Built by Specialists in Metal Fabrication

Careful attention to detail characterizes the work of Newport News craftsmen...

They've fabricated millions of tons of steel including corrosion-resistant alloy, clad and other special steels for many diverse industries.

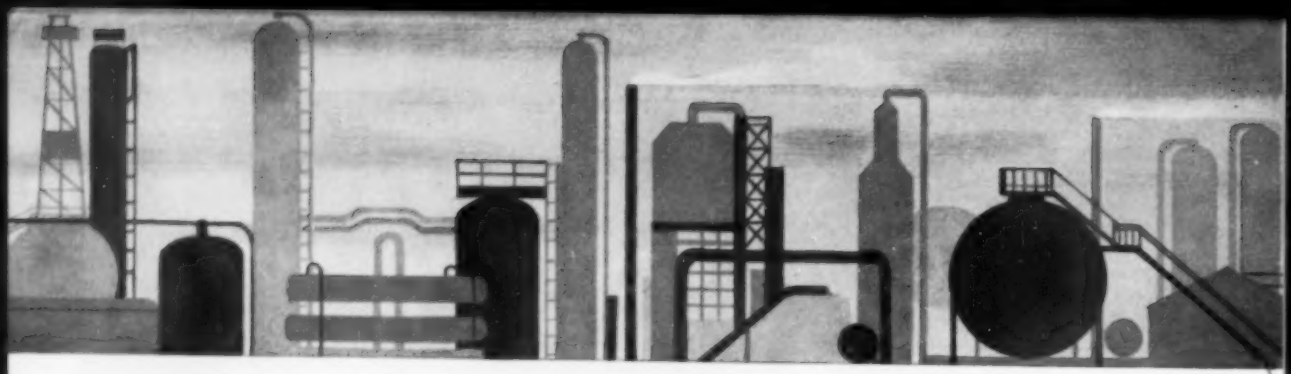
Newport News handles the job exactly as you want it done, for maximum results per dollar invested.

Specialized production techniques, advanced plant methods and a complete range of facilities along with many special purpose machines contribute to the excellence of Newport News fabrication.

Let us bid on equipment for your present or future projects. Learn how Newport News can help you...send for our booklet entitled "Facilities and Products." It's yours for the asking.

Newport News Shipbuilding and Dry Dock Company

Newport News, Virginia

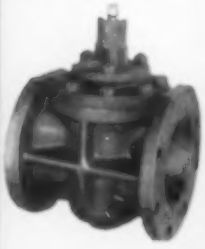


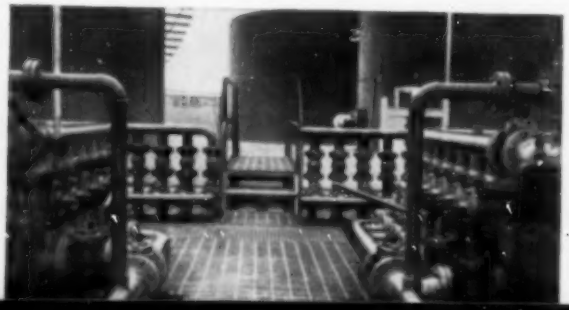
Where It PAYS To Use

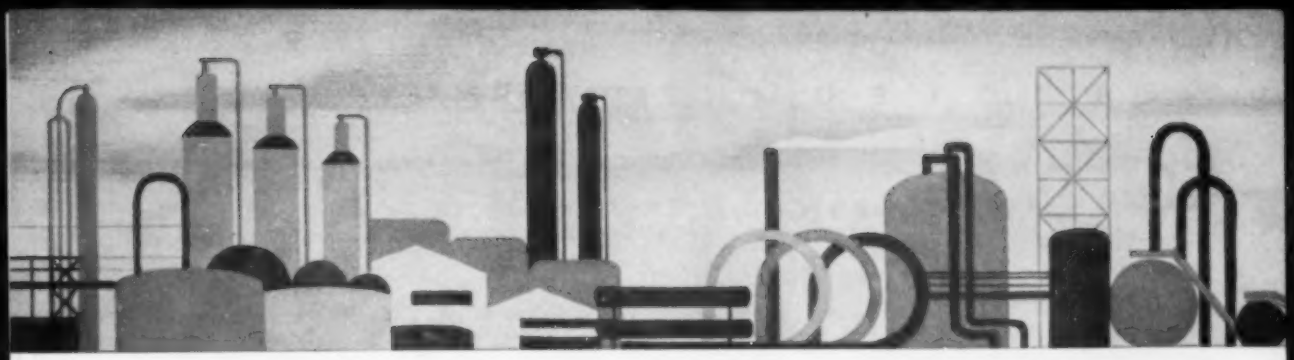
REFINERY VALVE CHECK LIST

Where To Use ROCKWELL-NORDSTROM Valves

- ☑ Transfer Lines
- ☑ Crude Lines To Refinery
- ☑ Heater Lines
- ☑ Towers
- ☑ Relief Valve Settings
- ☑ Lube Oil Treating
- ☑ Blending Lines
- ☑ Dewaxing
- ☑ Filtering
- ☑ Solvent Extraction
- ☑ Products Lines
- ☑ Tank Farms
- ☑ Loading Racks
- ☑ Fuel and Supply Lines
- ☑ Cat Crackers
- ☑ Platforming Units







Rockwell-Nordstrom Valves

For The Most Economical, Trouble-Free Refinery Valve Service

Look very carefully at the refinery valve check list on the left. If you are not now using Rockwell-Nordstrom valves at these important points, you have a real opportunity to make worth-while savings through longer, more trouble-free valve life, and lower repair, replacement and down time costs. Here are the reasons:

ECONOMICAL: Rockwell-Nordstrom valves are the most economical refinery valves you can use. Pressurized lubrication—which forms the time-proven leakproof seal—also eliminates metal-to-metal friction and "armor plates" the working parts against corrosive or erosive line material. And the valve seats, the parts that are "eaten out" fastest on ordinary valves, are *never* exposed to line material.

Rockwell-Nordstrom valves will start saving money for you the day they go on-stream because lubrication and rugged design eliminate costly repair and replacement and assure longer economic valve life.

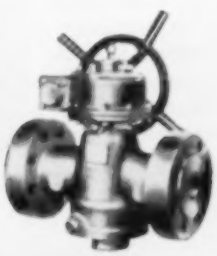
TROUBLE-FREE: Refinery engineers have been standardizing on Rockwell-Nordstrom valves for forty years. They've learned that the pressurized lubricant seal and positive shut-off assure *safe*, leakproof operation in *any* refinery service. Refinery operations men prefer Rockwell-Nordstrom valves because quarter turn closure permits accurate, smooth flow control. There are no bulky, large open cavities on Rockwell-Nordstrom valves; they require less space in manifolds. "Open-Close" guess work is eliminated—a glance at the wrench instantly tells plug position.

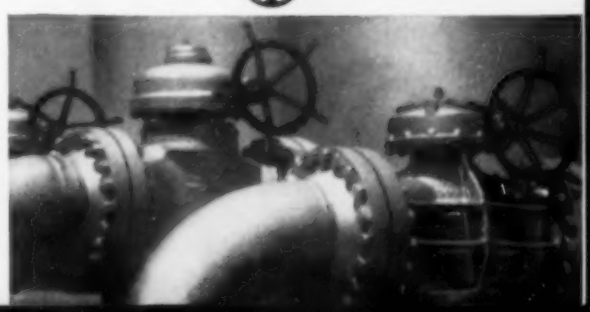
Rockwell-Nordstrom valves are available in *the only complete range* of lubricated plug valve sizes and pressure-temperature ratings in steel, semi-steel and corrosion resisting alloy patterns. Write for complete information today: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF





EDITORIALS . . .

Where the Bureau Should Work

A RECENT announcement from the Bureau of Mines states that part of the $1-million Congressional appropriation to continue shale oil activities at Rifle, Colo., will be used for special research to develop safer and more economical mining methods.

With that activity we're in agreement. We haven't always seen eye to eye with the Bureau in past years on its synthetic liquid fuels research program. We've been particularly against its semi-commercial scale "research" work in the processing field. There, we believe, private industry has shown itself quite competent and willing to develop the techniques and know-how which we'll need for making synthetic fuels in the event our petroleum reserves prove inadequate. And the oil industry isn't headed into a blind alley on such research; there's already a market for the petroleum products that might result.

But with the mining of shale the story is different. Even if someone should come up with better and safer ways to dig the stuff out of the ground, who wants to buy it? No commercial mining firm is likely to invest any research funds in such a project when there is no market for shale.

The Bureau, which doesn't have to be concerned with a financial payout on its research activities, has made notable contributions to this mining activity. Its continued efforts in this field are welcome.

Give Your "Second Mile" of Service

IN ANCIENT Hebrew days there was a law which gave a traveler who had lost his way the right to compel the first person he met to accompany him one mile and put him on the right path to his destination.

There was also (and is still) a biblical statement in the New Testament referring to that law: "Whosoever shall compel thee to go a mile, go with him two." The first mile was required. The second mile, if given, was of one's own volition, and out of a spirit of human kindness and helpfulness; it was a matter of personal choice.

Even as it was then, so is it now. Our city, state and federal governments levy taxes, and use a sizeable share of these taxes to support various community welfare and charitable projects. That's the "first mile"—the service to one's fellow men which we are required to give.

But there are other things which a good citizen desires for his community—things which the law does not require that he support. These are the health, recreational and family welfare services which every worthwhile community provides through its United Community Campaigns.

There is but one source of revenue for these modern "second mile" agencies and institutions: the voluntary donations of interested and responsible citizens.

Where do you fit into this picture and why are you finding quotations from the Scriptures in a technical magazine? It's because we believe that a lot more of our readers than realize it are very much affected by these "second mile" activities.

Perhaps only a few of you are directly involved in the actual campaigns—whether Community Chest, United Fund or Red Feather. More of you are concerned very intimately with the individual community activities they support—as Scout leaders, YMCA councilors, and the like. But every last one of you is indirectly connected through your families, your friends, your neighbors, your communities with one or more of the 21,000 welfare services which receive support through the United Community Campaigns. Included in the campaigns are such local services as clinics and visiting nurses, settlement houses and community centers, aids for the handicapped and counseling services, and (in some areas) national groups like Red Cross.

When your local campaign starts this fall, give it your full support. Give it your "second mile."

How Stanolind Helps Education

EVER since Stanolind Oil & Gas Co. moved into its new ultramodern Stanolind Research Center in southeast Tulsa two years ago, its old laboratories in the north section of Tulsa have lain largely idle. They comprised 29 brick and metal buildings, containing 44,000 sq. ft. of usable space and including laboratories, a chemical plant, a reactor tower, and machine shops—all situated on a 23-acre tract.

Recently, Stanolind figured out how to utilize these facilities in a most useful manner. It presented the complete package—land, buildings and equipment—to the University of Tulsa. "The possible uses of these facilities are limitless," said Dr. Clarence I. Pontius, Tulsa U. president. "At a time when all other universities in the land are worrying about increasing their plants, we have been handed . . . a campus complete with buildings."

University officials have named it the "North Campus" and plan to move many refining and production courses to it.

They see the Stanolind bequest as providing one of the finest petroleum engineering colleges in the country.

It isn't every company that has an excess research laboratory that it wants to get rid of. But Stanolind is to be commended for the unique way in which it has disposed of its—and at the same time been of great help to the cause of education.

BAKER & ADAMSON'S

VERSATILE Boron Trifluoride has rung the bell as a catalyst so many times . . . has "carried through" so many different organic syntheses . . . that some chemical engineers are beginning to think of BF_3 as almost universal in its applications.

For
Polymerization
Alkylation
Esterification
Acylation
And Many Other Reactions

THE NEXT synthesis problem it will help solve may well be *yours*. Write today for more detailed information on the properties and some of the uses of Baker & Adamson Boron Trifluoride and its complexes.

FINE CHEMICALS
BA
REAGENTS

BAKER & ADAMSON® *Fine Chemicals*
GENERAL CHEMICAL DIVISION, ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Please send me further information on Boron Trifluoride
☐ I would like general information on the properties and uses of Boron Trifluoride
☐ I would like specialized information on Boron Trifluoride for the following use:

Name _____
Company _____
Address _____
City _____ Zone ____ State _____

PP-9

Wyatt's... Floating Roof

....Its Seal fits the Shell regardless of Size or Configuration!

IT ASSURES...

- **Less Evaporation**
- **Less Corrosion**

. . . all the advantages and the mechanical advancements in WYATT'S FLOATING ROOF for the storage of crude oil and its products are contained in Brochure FR-P

Write to: WYATT METAL & BOILER WORKS
P. O. BOX 3052
HOUSTON, TEXAS

Wyatt's
HOUSTON-DALLAS-NEW YORK-TULSA

MANUFACTURERS AND ERECTORS SINCE 1913